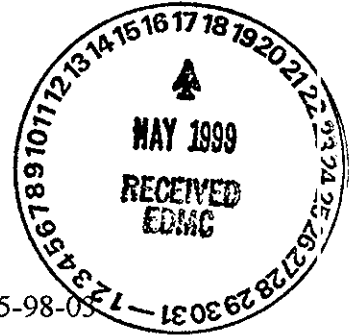


0050709

April 22, 1999

Mr. Tom Fitzsimmons, Director
Washington State Department of Ecology
P.O. Box 47600
Olympia, Washington 98504-7600

Mr. James Hall, Acting Manager
U.S. Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352



RE: Tri-Party Agreement (TPA) Milestone Change Package M-45-98-05

Dear Mr. Fitzsimmons and Mr. Hall:

50219

Thank you for providing an opportunity to comment on the above referenced change package. Although the public comment period has ended, it is my understanding that at least one more public hearing is scheduled to occur on May 12, 1999 at Hood River Oregon regarding TPA Milestone Change Packages M-45 and M-41. As with draft decision documents, I request that the public comment period be automatically extended to the close of any applicable public hearing. As evidenced by the extensive comments attached, I respectfully submit that a longer comment period was necessary. Therefore, I request that you accept the attached comments.

I have reviewed the proposed package and have found it incredibly deficient and utterly unenforceable. My comments and requests are so numerous I have itemized them in the attached list. It is my primary concern that the TPA change control package was written by person(s) with inadequate knowledge of the Resource Conservation and Recovery Act (RCRA) corrective action requirements. In particular, the RCRA requirements pertaining to the releases from the Single Shell Tank systems have not been met. In summary, I am greatly concerned about the quality of the negotiated conditions of this TPA milestone change package.

If you have any questions about the attached comments, requests, and/or attachments, I may be contacted at the address and/or telephone number provided below.

Sincerely,

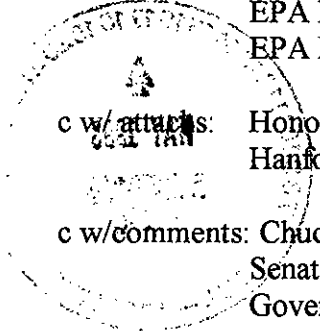
Alisa D. Huckaby
1524 Ridgeview Court
Richland, WA 99352
509/627-1162

April 22, 1999

TPA Change Number M-45-98-03

Page 2

attachments: Hanford SST RCRA Corrective Action Proposal Comments and Requests
B-BX-BY Comments and Cover Letter dated July 31, 1998
S-SX Comments and Cover Letter dated September 16, 1998
September 22, 1998 Memorandum Re: SST Impact to Groundwater
EPA Region IV's HSWA Permit Model Attachment E
EPA Region IV's HSWA Permit Model Part II Corrective Action



c w/attachs: Honorable Christine Gregoire
Hanford Administrative Record

c w/comments: Chucke Clark, EPA Regional Administrator
Senator Patty Murray
Governor Gary Locke

Hanford Site Single Shell Tank RCRA Corrective Action Proposal Comments and Requests

1. The description of the unresolved issue of the State Model Toxics Control Act (MTCA) in the second paragraph of the page entitled "Conclusion Agreement on Negotiation Under Milestone M-45" is not understood. In particular, this description does not sufficiently identify or describe the "issues associated with the applicability of MTCA" in order for a reviewer to make any conclusion. Therefore, it is requested that an attachment to the package be included which describes, in regulatory detail, the Ecology and USDOE positions of which agreement could not be reached. It is this reviewer's opinion that the public deserves to clearly understand what unresolved issues must be resolved prior to full implementation of this change request workscope.
2. The reference to the unresolved issue of MTCA in the second paragraph of the page entitled "Conclusion Agreement on Negotiation Under Milestone M-45" indicates "the parties agree that the issues associated with the applicability of MTCA need not be resolved in order to finalize this change request." It is requested that the following language be inserted en lieu of the existing language (quoted directly above until) such time that the MTCA issue(s) is(are) resolved: "The parties agree that the issues associated with the applicability of MTCA need to be resolved and agree to resolve them (as related to this milestone package) prior to August 1999".
3. Regarding the last sentence of the second paragraph entitled "Conclusion Agreement on Negotiation Under Milestone M-45", it is requested that the discussion meetings to resolve the MTCA issue be formalized by the issuance of meeting minutes. It is also requested that the meeting minutes be placed on the Hanford Site Administrative Record so that the public can better understand the issues, the decision-making process and the agreements reached.
4. The second sentence of the third paragraph on the page entitled "Conclusion Agreement on Negotiation Under Milestone M-45" indicates the public comment period "will be coordinated to ensure HAB opportunity for review and comment." It is this reviewer's understanding that the HAB (during the February 11-12 meeting), commented via a "sounding board" format whereby each individual interest on the Board had an opportunity to express its view(s). It is also this commentator's understanding that the majority of the Board remains skeptical about this project. It is requested that each comment made by each Board member regarding the Groundwater/Vadose Zone Integration Project be formally responded to in writing as a public comment regarding this TPA Milestone Change package.
5. A dispute resolution process is described in the third paragraph of the page entitled "Conclusion Agreement on Negotiation Under Milestone M-45". The dispute resolution process is related to resolving disputes which may arise from responding to public comment. An unresolved dispute would ultimately "be referred back for dispute resolution under the Tri-Party Agreement, Article VIII". It is recognized that

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this TPA Milestone change package is an agreement between Ecology and USDOE and does not include the public. It is also recognized that the dispute resolution process under TPA Article VIII does not include the public. Therefore, it is requested that if there is a dispute regarding a comment, that the dispute be identified in the Responsiveness Summary issued to address public comments. In addition, it is requested that party positions in relation to the dispute also be inserted into the Responsiveness Summary as the formal "response".

6. A dispute resolution process is described in the third paragraph of the page entitled "Conclusion Agreement on Negotiation Under Milestone M-45". As the public is not a party to the TPA and the dispute resolution process of Article VIII, it is requested that all disputes arising from public comments regarding this TPA Milestone change package be formally documented. In other words, it is requested that meeting minutes describing the issues, discussions and agreements be generated and entered onto the Hanford Administrative Record.
7. An expectation of approved changes to the agreement by April 15, 1999 is identified at the bottom of the page entitled "Conclusion Agreement on Negotiation Under Milestone M-45". A date of April 1999 for target milestone M-45-52-T01 is also noted. The public comment period is also noted to run to March 30, 1999. A public hearing is scheduled in Hood River, Oregon for May 12, 1999. As such, the public comment period should automatically be extended through May 12, 1999. All things respectfully considered, the expectation to approve changes to the Agreement by April 15, 1999 was extremely optimistic. Therefore, as changes to the Agreement were not made by April 15, 1999, it is requested that M-45-52-T01 be delayed until after the changes have been approved.
8. On page 1 of the Change Control Form, for regulatory clarification it is requested that the acronym "RCRA" be inserted in the following places:
 - After "(WMA)" and before "Corrective Actions" in the "Change Title" section.
 - After "HWMA" and before "groundwater assessment and monitoring" in the last sentence of the first paragraph in the "Description/Justification of Change" section.
 - After "related to" and before "corrective actions" in the first sentence in the "Impact of Change" section.
9. On page 1 of the Change Control Form, the "Affected Documents" section does not include RCRA Subpart S-like RCRA corrective action type documents (i.e., RCRA Facility Investigation [RFI], Corrective Measures Study [CMS], Corrective Measure Implementation [CMI] Plan, Data Quality Objectives [DQO], etc.). According to the milestones, this reviewer assumes several specific RCRA corrective action documents may be generated. If so, it is requested that an identification of each type of document to be generated be inserted into this section of the Change Control Form.
10. Regarding the "Affected documents" section of Page 1 of the Change Control Form, it is requested that the documents associated with the Columbia River Comprehensive

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Impact Assessment be identified, if applicable. Similarly, it is requested that the documents to be affected pertaining to SST RCRA assessment groundwater monitoring reports, associated past practice sites (as listed in Attachment One to the TPA milestone change package), etc. also be identified, if applicable.

11. As this TPA milestone change package only addresses interim milestones and Ecology is the lead regulator, it is requested that the EPA signature line be deleted in the "Approvals" section of page 1 of the Change Control Form. Otherwise, the blank signature could be interpreted to indicate a lack of concurrence by the third party.
12. On page 2 of the Change Control Form, the term "Compliance" has no regulatory meaning in relation to RCRA groundwater monitoring programs at interim status units/facilities. It is requested that the words "Compliance and" be deleted in the first sentence of the first paragraph on page 2.
13. On page 2 of the Change Control Form, the first sentence of the third paragraph states "Notwithstanding DOE's groundwater monitoring program which presently is in compliance with HWMA and RCRA interim status standards for TSDs." This reviewer has seen no documentation to support this statement. Such documentation would take the form of an evaluation commonly referred to as a RCRA "Comprehensive Ground-Water Monitoring Evaluation" (CME). The TPA has no provisions for CMEs and to this reviewer's knowledge, neither Ecology nor EPA have performed a CME at Hanford. Another form of appropriate documentation communicating such a compliance determination would consist of a permit issued for the SSTs containing groundwater monitoring conditions. Furthermore, based on my personal conversation with the Washington State hydrogeologist assigned to review the SST WMA's groundwater monitoring systems and programs, it has been communicated to me that the SST groundwater monitoring systems and programs are not in compliance. If the author(s) of this milestone change package believes this milestone constitutes the formal compliance determination, it is respectfully offered that the author(s) are either uninformed or has(have) chosen not to acknowledge the numerous deficiencies associated with the existing groundwater monitoring systems and programs. If the latter is the case, it is requested that the author(s) acknowledge the deficient groundwater monitoring systems and programs in response to this comment. It is also noted that to date, the Hanford RCRA permit has not been modified to include conditions applicable to SSTs. The reviewer requests that either the appropriate documentation be provided or that the statement be deleted.
14. On page 2 of the Change Control Form, the first sentence of the third paragraph states "Notwithstanding DOE's groundwater monitoring program which presently is in compliance with HWMA and RCRA interim status standards for TSDs." The Parties are directed to two RCRA assessment monitoring documents entitled "Results of Phase I Groundwater Quality Assessment for Single-Shell Tank Waste Management Areas B-BX-BY at the Hanford Site" and "Results of Phase I Groundwater Quality Assessment for Single-Shell Tank Waste Management Areas S-SX at the Hanford Site". The Parties are also directed to two issuances of comments by Ecology

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regarding these documents. Both sets of comments are attached for the Party's review. This reviewer respectfully offers that the groundwater assessment programs for the B-BX-BY and S-SX WMAs are deficient. To further explain, interim status assessment monitoring program requirements (see 40 CFR 265.93(d)(3) and (4) applicably referenced by WAC 173-303-400) require the owner or operator to: **"at a minimum, determine: (i) The rate and extent of migration of the hazardous waste or hazardous waste constituents in the ground water; and (ii) The concentrations of the hazardous waste or hazardous waste constituents in the ground water."** Therefore, by virtue of not satisfying interim status assessment monitoring requirements, it is erroneous to conclude that the present groundwater monitoring programs are in compliance with RCRA interim status standards for TSDs. In other words, in light of the numerous deficiencies presently associated with the assessment plans, this reviewer could easily argue that the groundwater monitoring programs are not "presently" in compliance with HWMA and RCRA interim status standards for TSDs. Therefore, it is requested that the identification of the deficiencies associated with these two WMAs be identified in the TPA milestone change package. In addition, it is requested that the specific deficiencies previously identified by Ecology be either summarized or directly referenced.

15. On page 2 of the Change Control Form, the first sentence of the third paragraph states "Notwithstanding DOE's groundwater monitoring program which presently is in compliance with HWMA and RCRA interim status standards for TSDs." It is the reviewer's opinion that the statement is so erroneous that the credibility of the entire TPA milestone change package is jeopardized. The reviewer requests that the statement be deleted. It is also requested that a current status of the groundwater monitoring systems and programs be included in the milestone change package. Lastly, it is requested that a schedule by which the non-compliant groundwater monitoring systems and programs will come into compliance be established and included in the milestone change package.
16. On page 2 of the Change Control Form, the first sentence of the third paragraph states "Notwithstanding DOE's groundwater monitoring program which presently is in compliance with HWMA and RCRA interim status standards for TSDs." As indicated in the previous comment, this reviewer believes an identification of information considered during the decision-making process would improve the credibility of the TPA milestone change package. It is this reviewer's understanding that a memorandum dated September 22, 1998 issued by two technical Ecology staff was retracted from the Hanford Site administrative record by Ecology management after a copy of the memorandum had been requested by representatives of the Yakama Indian Nation and Heart of America. Please find a copy of the memorandum attached. It is requested that a copy of the memorandum be replaced on the Hanford Site administrative record. As the information contained in this memorandum is directly related to the subject/issue of this TPA milestone change package, it's placement on the Hanford Site administrative record is the responsibility of the Washington State Department of Ecology under the TPA and under the intent of WAC 173-303-840. It is this reviewer's understanding that all information

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considered in development of TPA milestones is a direct, if not inherent, applicability to the RCRA corrective action requirements which will ultimately be incorporated into closure, post-closure, and/or corrective action permits. In addition, it is requested that an itemization of the administrative record documents (on which TPA milestones and Hanford permits are based) which support this agreement be either attached to this package or referenced in full.

17. On page 2 of the Change Control Form, the first sentence of the third paragraph states "Notwithstanding DOE's groundwater monitoring program which presently is in compliance with HWMA and RCRA interim status standards for TSDs." As indicated by previous comments, this reviewer knows of no such compliance evaluation or determination made in relation to the SST WMA's. In light of the comments issued by Ecology regarding the deficient assessment plans, a status of the assessment plans is requested. In particular, a status of the resolution of Ecology's comments regarding the B-BX-BY and S-SX tank farm's assessment plans is requested. Similarly, a schedule identifying when or if Ecology will make a defensible compliance evaluation and determination in relation to the S-SX, B-BX-BY and TX-TY RCRA interim status groundwater monitoring systems and programs is requested to be made a part of this TPA milestone change package.
18. The last paragraph on page 2 and the four items on page 3 of the TPA milestone change package identify specific documents for which an integration commitment is made. Of notable absence are the "Columbia River Comprehensive Impact Assessment", the TWRS Environmental Impact Statement (EIS), and the Retrieval Performance Evaluation (RPE). It should be noted that the TWRS EIS alternatives groundwater contamination transport modeling was based on limited information available at the time of issuance. It is requested that an identification of degree of commitment in relation to integration of information into these two particular documents be made in your response to my comments.
19. On page 3 of the Change Control Form, the term "Compliance" has no regulatory meaning in relation to RCRA groundwater monitoring programs at interim status units/facilities. It is requested that the words "Compliance and" be deleted in the first sentence of the first item on page 3.
20. On page 3 of the Change Control Form, the first sentence of the first paragraph identifies that a RCRA Subpart S-like corrective action process as described in the TPA will be used. The second sentence of the same paragraph identifies the corrective action process will be "coordinated over time in order to support closure" of the SSTs. Administratively, considering the length of time until the first SST closure/post-closure plan is submitted (2006) and approved (via amendment of the Hanford Site permit) and implemented (2012 -2014), it is recommended that an identification of all potential administrative processes for instituting corrective action be inserted into the TPA change control form language. To explain further, the administrative process of permitting units/facilities for corrective action can be very lengthy and it is likely that the complex corrective action process associated with the SST WMAs will take considerable time and resources to reach implementation. Prior

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to implementation of the corrective action, contamination already in the vadose and groundwater will continue to migrate. Therefore, it is recommended that an identification of all administrative processes which may be used to facilitate a timely implementation of corrective action measures be included in the change package language. The flowsheet of corrective actions and closure (as an attachment to the change control form) illustrates the importance of a recognition of enforcement tools which can be used to require a timely implementation of corrective action measures in the event that greater contamination is discovered than previously known or understood.

21. On page 3 of the Change Control Form, the next to last sentence of the first paragraph identifies a requirement that the reviewer is unaware of in relation to the HWMA or RCRA corrective action requirements. The text states "These decisions require an understanding of the effectiveness and cost of measures that can be taken...". The reviewer requests that either a regulatory (RCRA Dangerous Waste Code [WAC 173-303] or HWMA) requirement be cited or an explanation of the statement be included in the text. For example, if a cost analysis of various corrective measures must be performed to satisfy NEPA requirements, the TPA Change Control should identify exactly which requirements are being satisfied. The reviewer knows of no such RCRA HWMA or WAC requirement and believes the statement could mislead persons who are not as knowledgeable of RCRA requirements.
22. On page 3 of the Change Control Form, the next to last sentence of the first paragraph identifies a requirement that the reviewer is unaware of in relation to the HWMA or RCRA corrective action requirements. The text states "These decisions require an understanding of the effectiveness and cost of measures that can be taken to avoid or limit additional releases, or to control subsurface movement of contaminants to minimize additional insult to human health and the environment from SST wastes.". It is requested that clarification be added which differentiates between contamination investigation and actual corrective action activities. To further explain, Table 1 of the Change Control Form identifies "initial activities" (numbers 1, 2, 3, 4, 5, 6, 7, 11, and 12) which the reviewer considers to constitute certain necessary immediate corrective action activities. The rest of Table 1 does not appear to represent activities which would meet the stated objective, but rather to investigate the extent of contamination. To further explain, the reviewer draws a distinction between actual field activities and the evaluation of data/information. Therefore, it is requested that the milestone Change Package clarify this issue by making a distinction between funding field activities versus funding evaluation activities. In other words, field activity funding for corrective action preventative measures (water line testing, sealing of abandoned wells, capping of boreholes, investigation of surface water runoff and ponding, control and/or reconfigure drainage, borehole decommissioning and sampling, etc.) should not be subject to budget limitations or budget considerations which could delay implementation of these preventative measures.
23. On page 3 of the Change Control Form, the next to last sentence of the first paragraph identifies a requirement that the reviewer is unaware of in relation to the HWMA or RCRA corrective action requirements. The text states "These decisions require an

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understanding of the effectiveness and cost of measures that can be taken to avoid or limit additional releases, or to control subsurface movement of contaminants to minimize additional insult to human health and the environment from SST wastes.”. It has previously been noted that the interim status groundwater monitoring programs are deficient and noncompliant. This reviewer understands the need for this TPA milestone is such that the extent, concentration, and rate of migration of the contamination related to the SST WMAs may be understood so that ultimately, corrective action can be designed and implemented. As previously identified, the extent, concentration, and rate of migration is not currently understood. Therefore, to write a consent order condition which subjects the activities to support the necessary understanding to current budget constraints may not represent the most protective approach. For example, if the extent, concentration, and rate of migration is not understood, the parties are left with inadequate information on which to design a corrective action program. Similarly, if the extent, concentration, and rate of migration is not understood, an erroneous conclusion may be arrived at. For example, if contamination is not measured, it is this reviewer’s concern that it may be erroneously concluded that contamination does not exist. This would of course, be an erroneous conclusion. Therefore, this reviewer recommends that only the final corrective action proposal be subject to budget considerations as stated in the milestone package, but not the investigation process which should allow for the extent, concentration and rate of contaminant migration to be understood.

24. On page 3 of the Change Control Form, the next to last sentence of the first paragraph identifies a requirement that the reviewer is unaware of in relation to the HWMA or RCRA corrective action requirements. The text states “These decisions require an understanding of the effectiveness and cost of measures that can be taken....”. The reviewer has previously questioned the source of the requirement. It is noted that the Corrective Actions and Closure flowpath does not identify administrative NEPA processes. If NEPA is indeed the driver of the cost analysis, it is requested that the Corrective Actions and Closure flowpaths be modified to reflect administrative NEPA procedural requirements.
25. On page 3 of the Change Control Form, the next to last sentence of the first paragraph identifies a requirement that the reviewer is unaware of in relation to the HWMA or RCRA corrective action requirements. The text states “These decisions require an understanding of the effectiveness and cost of measures that can be taken....”. If this text is not removed, it is requested that an identification be made of when the budget considerations will occur in relation to the activities on the closure and corrective action flowchart. In particular, if this text is not removed, it is requested that budget activities which support this TPA milestone change package be identified as separate actions. Similarly, it is requested that an identification of the costs associated with these budget considerations be identified in the TPA milestone change request package. It is this reviewer’s concern that the very act of evaluating the budget and the cost of corrective or interim actions could be prohibitively costly if not performed in an efficient manner.

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26. On page 3 of the Change Control Form, the first sentence of the last paragraph states "Development of the Phase 1 RFI/CMS Work Plan including site-specific SST WMA Phase 1 RFI/CMS Work Plan addenda will be designed to meet regulatory objectives which shall include the following: (1) compliance with interim status standards and corrective action requirements of the HWMA and RCRA (i.e., requirements which apply in the instance of releases from a TSD facility....". Considering the statement on page 2 which indicates the groundwater monitoring program is currently in compliance with HWMA and RCRA interim status standards for TSDs, the page 3 change control form language is confusing. This reviewer requests that clarification language be added to this text. As identified above, RCRA interim status requirements require that the rate, extent of migration and concentration of waste and/or waste constituents in the ground water be determined (see 40 CFR 265.93(d)(3) and (4) referenced by WAC 173-303-400). This reviewer agrees with the text's inferral that the SST WMA groundwater programs identified in this TPA change package are not currently compliant. The reviewer requests that clarifying language be added which explains that RCRA groundwater monitoring programs are required to be compliant and that the RFI RCRA Subpart S process typically addresses those solid waste management units for which the extent of contamination has not yet been determined. It is this reviewer's concern that the TPA change control package was written by person(s) with inadequate knowledge of RCRA requirements or the current status of these particular SST WMAs.
27. On page 4 of the Change Control Form, the sixth sentence of the first complete paragraph states "The parties recognize it is likely that more than one iteration of site specific investigation will be conducted prior to obtaining sufficient information to proceed to decision making documentation." As stated previously, the RCRA SST WMA interim status assessment groundwater monitoring programs are currently deficient. As such, it is this reviewer's opinion that the likelihood that "more than one iteration of site specific investigation will be conducted prior to obtaining sufficient information to proceed to decision making documentation" is extremely high. This reviewer requests that the text be changed to identify the existing deficient groundwater monitoring programs. The reviewer also requests that the text and schedule be modified to identify at least two iterations of site specific investigations will be conducted prior to obtaining sufficient information to proceed.
28. On page 4 of the Change Control Form, it is stated "If so, updates to the RFI/CMS work Plan will be made to collect additional data for decision on interim corrective measures, retrieval and closure." This reviewer understands that the Washington State Department of Ecology is not currently authorized pursuant to Section 3006 of RCRA, as amended, 42 U.S.C. § 6926 to issue the HSWA Subpart S-like portion of RCRA permits. It is also understood that the Washington State Department of Ecology was authorized to implement RCRA corrective action requirements through compliance with MTCA (a Superfund-like approach). It is also recognized that the MTCA process is not implemented at the Hanford Site, but rather, the RCRA corrective Subpart S-like corrective action requirements through the TPA consent order. Furthermore, it is understood that after delegation of the corrective action requirements of HSWA by the EPA to the State, the Hanford Site RCRA permit will

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be modified through a Washington State-initiated permit modification to incorporate the specific requirements of the HSWA permit into Washington State's portion of the Hanford Site RCRA permit. It is also understood that the HSWA corrective action conditions of Part III of the RCRA Hanford Site permit (issued to U.S. Ecology) were modeled after the HSWA corrective action conditions used by EPA, Region IV. It is also understood that U.S. Ecology's permit contains conditions (under Attachment E) for "Interim Measures Requirements." It is also recognized that the TPA "Remedial and Corrective Action description (under "Executive Summary for Hanford Federal Facility Agreement And Consent Order Action Plan") does not include provisions for RCRA corrective action interim measures requirements. Therefore, it is this reviewer's opinion that the use of the term "interim corrective measures" could be confusing to the public, those striving to comply with the conditions of the milestone and those overseeing the implementation of this milestone. For convenience, a copy of U.S. Ecology's "Interim Measures Requirements" is included for the parties' reference. This reviewer appreciates and supports the use of formal interim measures requirements. In appreciation that Washington State Department of Ecology is not currently authorized for this particular requirement and that the TPA does not appear to include it as a RCRA corrective action requirement, it is requested that the entire interim measures requirements language as contained in U.S. Ecology's permit (see attached) be inserted into this TPA milestone change package. Again, this reviewer is concerned about the quality of the negotiated conditions of this TPA milestone change package. It is also this reviewer's concern that the requirements of this package, as currently written, would be difficult to enforce.

29. On page 4 of the Change Control Form, it is stated "The iterative nature of this process is illustrated in Attachment Two." It is requested that the comment immediately preceding this comment also be considered now. As such, this reviewer commends the Parties for the accuracy and clarity of Attachment Two because the corrective action flow chart correctly shows interim measures as actions which can occur concurrently with the slower, more laborious RFI/CMS activities. As this reviewer does not believe that "complete upgrading of leak-tight caps on monitoring drywells around SSTs" (TPA milestone M-45-57) and the water line isolation work of milestone M-45-56 will be the only "interim measures" required within this important milestone package workscope, it is requested that the corrective action flowchart of Attachment Two be redrawn to identify that M-45-57, M-45-56 and M-45-55 interim measures should or could be occurring simultaneously and may evolve to include numerous interim measures boxes. Again, it is requested that the term "interim measures" be clearly defined and differentiated from the term "RFI/CMS".
30. On page 4 of the Change Control Form, the "initial work plan data evaluation and subsurface modeling" is described. It is this reviewer's opinion that while performing this work, newly identified solid waste management units (SWMUs), areas of concern (AOCs), unremediated unplanned releases, etc. will be discovered. As such, this reviewer requests that notification and assessment requirements be added to this TPA milestone package. As indicated previously, RCRA HSWA permit conditions from a Subpart S corrective action model developed by EPA, Region IV are available for Ecology's use. For convenience, please find attached pages 13-15 (of 27) of

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notification and assessment requirements for newly identified SWMUs and AOCs. In recognition that the TPA "Remedial and Corrective Action" description (under "Executive Summary for Hanford Federal Facility Agreement and Consent Order Action Plan") does not include provisions for newly identified SWMUs and AOCs, the HSWA corrective action permit conditions are requested to be inserted into the TPA milestone change package. Also, in recognition that the Washington State Department of Ecology is not currently authorized pursuant to Section 3006 of RCRA, as amended 42 U.S.C. § 6926, to issue the HSWA Subpart S-like portion of RCRA permits, the EPA Region IV HSWA model permit conditions for newly identified SWMUs and AOCs are requested to be inserted in the TPA milestone package.

31. On pages 4 and 5 of the Change Control Form, the "initial work plan data evaluation and subsurface modeling" and "implementation of initial interim measures" are described. As has been previously requested, and is again requested, the inclusion of interim measures requirements language and the specific identification of interim measures to be performed would greatly improve the clarity of the TPA Milestone change package. It is noted that while "upgrading leak tight caps on monitoring drywells around SSTs" constitutes a RCRA interim measure, the conductance of engineering studies and workshops does not meet the RCRA subpart S-like corrective action interim measurement requirement intent. Therefore, it is requested that the conductance of engineering studies and workshops be performed as part of the RCRA Corrective Measure Study Process and not the interim measures activities. Similarly, it is requested that the initial activities in Table 1 which represent interim measures be identified in this section of the TPA milestone change package text. Specifically, it is requested that water line testing, sealing of abandoned wells, capping of abandoned boreholes, the implementation of drainage control remedies, the provision of surface barriers, and the decommissioning and sampling of borehole 41-09-39 be identified as "interim measures".
32. On page 6 of the Change Control Form, it is requested that on Table 1, an identification of exactly which activities are considered "interim measures" be made.
33. On page 6, it is requested that on Table 1, procedural activities to respond to newly identified SWMUs and AOCs be inserted into the table.
34. On page 7 of the Change Control Form, milestone M-45-51 states "Submit to Ecology for review and approval....". The last sentence of the milestone states "Work implemented under the RFI/CMS Work Plan (including revisions and site specific SST WMA RFI/CMS Work Plan addenda) must be approved by Ecology in writing prior to implementation.". It is respectfully submitted that this approach, as has been repeatedly observed by the submittals of incomplete RCRA Part B permit applications and closure plans under TPA's major milestone M-20-00, has neither been efficient nor incentivizes the regulated entity to submit quality permits or plans. For example, the closure plan for the 100 D Ponds was deficient and the numerous deficiencies were only resolved over a lengthy time period. Similarly, 224-T TRUSAF's Part B permit application was so deficient that the significantly large

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number of deficiencies were not resolved prior to a mission change for the building. Similarly, the 324 Building B Cell closure plan was so incomplete, hundreds of deficiencies were necessary to be resolved prior to Ecology's approval of the closure plan. Similarly, the Double Shell Tank System's Part B permit application's Waste Analysis Plan (WAP) was so deficient, Ecology representatives re-wrote and issued the DST WAP after two years of working to reach an agreement. Similarly, 219-S tank system's WAP was so deficient that Ecology staff re-wrote the WAP and issued it after several months of working to reach an agreement. It should be noted that it is this commentor's understanding that in the example of the 219-S tank system WAP, en lieu of accepting Ecology's re-write, the facility simply has not accepted off-unit waste into the 219-S tank system since the compliance action was initiated. Therefore, it may be concluded that the language of M-20-00 does not yield quality submittals or incentivize expediency. Therefore, the following language is requested to be used rather than the inefficient and decentivized "submit and approve" approach.

DOE shall prepare and submit to Ecology a RCRA Facility Investigation (RFI) Work Plan for the SST WMAs. This Work Plan shall meet the minimum requirements as specified immediately below. The Work Plan shall include schedules of implementation and completion of specific actions necessary to determine the nature and extent of releases and the potential pathways of contaminant releases to the air, land, surface water, and groundwater. DOE must provide sufficient written justification for any omissions or deviation from the minimum requirements as specified immediately below. Such omissions or deviations are subject to the approval of Ecology.

The RFI/CMS Work Plan shall provide the overall framework within which site-specific SST WMA RFI/CMS Work Plan addenda will be prepared. The SST WMA RFI/CMS Work Plan will be designed to meet regulatory objectives which shall include the following: (1) compliance with interim status corrective action requirements of the HWMA and RCRA, (i.e., requirements applicable in the instance of releases from a TSD facility, requirements applicable in the instance of RCRA interim status assessment groundwater monitoring, requirements applicable in the instance of newly discovered SWMUs or AOCs, requirements applicable in the instance of interim measures, etc.), (2) the generation of groundwater/vadose zone characterization data/information necessary to: (i) define the sources, nature, and extent of vadose zone and aquifer contamination, (ii) identify actual and potential receptors (via air, land, surface water and the groundwater pathways), (iii) determine the need for additional interim

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measures or interim corrective measures, and (3) support closure of SST TSDs under the HWMA and RCRA.

The RFI/CMS Work Plan shall describe objectives, criteria that will be used in making groundwater/vadose zone decisions, technical framework for decision-making, regulatory framework, principal interfaces, task prioritization, planning activities, generic information and requirements for site-specific plans, and schedules. Coordination of SST WMA activities with related vadose zone and groundwater activities under DOE's Environmental Restoration Program will be documented (e.g., RCRA groundwater monitoring well installation and sampling, characterization of past practice sites, use of groundwater and vadose zone contaminant transport models, corrective actions at neighboring sites).

The Work Plan must be approved by Ecology, in writing, prior to implementation. Ecology shall specify the start date of the RFI Work Plan schedule in the letter approving the RFI Work Plan. If Ecology disapproves the RFI Work Plan, Ecology shall either (1) notify DOE in writing of the RFI Work Plan's deficiencies and specify a due date for submission of a revised RFI Work Plan, or (2) revise the RFI Work Plan and notify DOE of the revisions and the start date of the schedule within the approved RFI Work Plan. Ecology may issue a maximum of two notices of deficiencies prior to either declaration of the milestone as "missed" or revision and issuance of the RFI Work Plan. The generation or revision of issuance of an Ecology approved RFI Work Plan shall represent fulfillment of this TPA Milestone.

RFI Implementation. DOE shall implement the RFI in accordance with the approved RFI Work Plan(s). The TPA Milestone shall be revised to identify the established RFI Implementation date. DOE shall notify Ecology within seven (7) days of any field activity.

RFI Reports. If the time required to conduct the RFI is greater than 180 calendar days, DOE shall provide Ecology with quarterly RFI Progress Reports (90 day intervals) beginning ninety (90) calendar days from the start date specified by Ecology in the RFI Work Plan approval letter. The Progress Reports shall contain the following information at a minimum:

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- i. A description of the portion of the RFI Work Plan completed;
- ii. Summaries of findings;
- iii. Summaries of all deviations from the approved RFI Work Plan during the reporting period;
- iv. Summaries of all problems or potential problems encountered during the reporting period;
- v. Projected work for the next reporting period; and
- vi. Copies of daily reports, inspection reports, laboratory/monitoring data, etc.

35. On page 8 of the Change Control Form, milestone M-45-52 states "Submit to Ecology for review and approval as an Agreement primary document a site-specific SST WMA Phase 1 RFI/CMS Work Plan addenda for WMA S-SX." As stated in the previous comment, the referenced examples also apply to this milestone. Therefore, it may be concluded that the language of M-20-00 does not yield quality submittals or incentivize expediency. Therefore, the following language is requested to be used rather than the inefficient and decentivized "submit and approve" approach.

DOE shall prepare and submit to Ecology a RCRA Facility Investigation (RFI) Work Plan addenda for WMA S-SX. The document shall be considered an Agreement primary document. This addenda (S-SX Addenda) shall meet the minimum requirements as specified immediately below. The addenda shall include schedules of implementation and completion of specific actions necessary to determine the nature and extent of releases and the potential pathways of contaminant releases to the air, land, surface water, and groundwater. DOE must provide sufficient written justification for any omissions or deviation from the minimum requirements as specified immediately below. Such omissions or deviations are subject to the approval of Ecology.

Approval of this S-SX Addenda will enable initial fieldwork and borehole installation to commence in Fiscal Year 1999. This plan will describe and schedule the gathering of specific information for WMA S-SX Tank farms necessary to meet the objectives developed through a data quality objectives (DQO) process. The plan will also define specific locations and methods for sampling and analysis to meet work plan objectives. This plan will identify requirements for groundwater sampling from initial vadose zone boreholes, and vadose zone sampling from planned groundwater monitoring wells.

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The S-SX Addenda and all supporting DQOs must be approved by Ecology, in writing, prior to implementation. Ecology shall specify the start date of the S-SX Addenda schedule in the letter approving the addenda. If Ecology disapproves the addenda and supporting DQOs, Ecology shall either (1) notify DOE in writing of the addenda's and DQO's deficiencies and specify a due date for submission of a revised addenda and DQO, or (2) revise the addenda and DQO and notify DOE of the revisions and the start date of the schedule within the approved addenda and DQO. Ecology may issue a maximum of two notices of deficiencies prior to either declaration of the milestone as "missed" or revision and issuance of the addenda and DQO.

The generation or revision of issuance of an Ecology approved addenda and DQO shall represent fulfillment of this TPA Milestone.

S-SX Addenda Implementation. DOE shall implement the addenda and DQO in accordance with the approved addenda and DQO. The TPA Milestone shall be revised to identify the established S-SX addenda implementation date. DOE shall notify Ecology within seven (7) days of any field activity.

S-SX Addenda Reports. If the time required to conduct the addenda and DQO is greater than 180 calendar days, DOE shall provide Ecology with quarterly S-SX Addenda Progress Reports (90 day intervals) beginning ninety (90) calendar days from the start date specified by Ecology in the S-SX Addenda approval letter. The Progress Reports shall contain the following information at a minimum:

- vii. A description of the portion of the S-SX Addenda and DQO completed;
- viii. Summaries of findings;
- ix. Summaries of all deviations from the approved S-SX Addenda and DQO during the reporting period;
- x. Summaries of all problems or potential problems encountered during the reporting period;
- xi. Projected work for the next reporting period; and
- xii. Copies of daily reports, inspection reports, laboratory/monitoring data, etc.

36. On page 8 of the Change Control Form, milestone M-45-53 states "Submit to Ecology for review and approval as an Agreement primary document a site-specific

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SST WMA Phase 1 RFI/CMS Work Plan addenda for WMA B-BX-BY.” For the reasons explained above, the following language is proposed:

DOE shall prepare and submit to Ecology a RCRA Facility Investigation (RFI) Work Plan addenda for WMA B-BX-BY. The document shall be considered an Agreement primary document. This addenda (B-BX-BY Addenda) shall meet the minimum requirements as specified immediately below. The addenda shall include schedules of implementation and completion of specific actions necessary to determine the nature and extent of releases and the potential pathways of contaminant releases to the air, land, surface water, and groundwater. DOE must provide sufficient written justification for any omissions or deviation from the minimum requirements as specified immediately below. Such omissions or deviations are subject to the approval of Ecology.

This plan will describe and schedule the gathering of specific information for WMA B-BX-BY Tank farms necessary to meet the objectives specified in the SST RFI/CMS Work Plan. The plan will also define specific locations and methods for sampling and analysis to meet work plan objectives. This plan will identify requirements for groundwater sampling from initial vadose zone boreholes, and vadose zone sampling from planned groundwater monitoring wells. In addition, the plan will identify data needs from the characterization of past practice sites to resolve SST WMA data gaps.

The B-BX-BY Addenda must be approved by Ecology, in writing, prior to implementation. Ecology shall specify the start date of the B-BX-BY Addenda schedule in the letter approving the addenda. If Ecology disapproves the addenda, Ecology shall either (1) notify DOE in writing of the addenda's deficiencies and specify a due date for submission of a revised addenda, or (2) revise the addenda and notify DOE of the revisions and the start date of the schedule within the approved addenda. Ecology may issue a maximum of two notices of deficiencies prior to either declaration of the milestone as “missed” or revision and issuance of the addenda.

The generation or revision of issuance of an Ecology approved addenda shall represent fulfillment of this TPA Milestone.

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B-BX-BY Addenda Implementation. DOE shall implement the addenda in accordance with the approved addenda. The TPA Milestone shall be revised to identify the established B-BX-BY addenda implementation date. DOE shall notify Ecology within seven (7) days of any field activity.

B-BX-BY Addenda Reports. If the time required to conduct the addenda is greater than 180 calendar days, DOE shall provide Ecology with quarterly B-BX-BY Addenda Progress Reports (90 day intervals) beginning ninety (90) calendar days from the start date specified by Ecology in the B-BX-BY Addenda approval letter. The Progress Reports shall contain the following information at a minimum:

- xiii. A description of the portion of the B-BX-BY Addenda completed;
- xiv. Summaries of findings;
- xv. Summaries of all deviations from the approved B-BX-BY Addenda during the reporting period;
- xvi. Summaries of all problems or potential problems encountered during the reporting period;
- xvii. Projected work for the next reporting period; and
- xviii. Copies of daily reports, inspection reports, laboratory/monitoring data, etc.

37. As may be surmised by the three previous comments, it is requested that milestones M-45-54, M-45-55, M-45-56, M-45-57, M-45-58, M-45-59, and M-45-60 be re-written similarly as provided above to agree with the conventional RCRA Subpart S-like corrective action described by the TPA, to provide RCRA Subpart S detail and consistency where the TPA is silent, to clarify, to promote efficiency and to promote incentive to fulfill the terms of the milestone (i.e., comply).
38. It is requested that the table which identifies "tank waste-related units and ER sites associated with SST WMA's" correctly identify the 107 SSTs, the 27 diversion boxes, the 10 catch tanks, the 3 receiving vaults/vaults, and the 4 valve pits be identified as SST TSD ancillary equipment. Furthermore, it is requested that the tank waste-related units be clearly differentiated from the ER sites.
39. Note 1 on the table which identifies "tank waste-related units and ER sites associated with SST WMA's" indicates that the table does not include unplanned release (UPR) sites. It is noted that Appendix B of the TPA is a listing of TSD groups/units of which numbered "unplanned releases" (UPs) are identified. Because the TPA UPs are neither described sufficiently for recognition nor inclusively identified, it is requested that UP information be included in this TPA change package. Specifically, and for purposes of this RCRA corrective action effort, it is requested that all SST UPRs be identified by description of location, amount of released material,

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April 22, 1999

description of released material and date of release. These UPRs are well documented and have a direct bearing on the RFI/CMS process. For example, a document entitled "Vadose Zone Characterization Project at the Hanford Tank Farms SX Tank Farm Report" (September 1996) identifies and describes 15 UPRs. Similarly, a document entitled "Vadose Zone Characterization Project at the Hanford Tank Farms S Tank Farm Report" (February 1998) identifies and describes four UPRs.

40. The Corrective Actions and Closure flowpath included in the milestone change package as an attachment identifies that Interim Measures may only occur through milestone M-45-57. It is recommended that the flowpath either remove the milestone number or include all applicable numbers during which interim measures may occur.
41. The Corrective Actions and Closure flowpath included in the milestone change package as an attachment identifies that Additional Interim Measures may only occur through milestone M-45-56. It is recommended that the flowpath either remove the milestone number or include all applicable numbers during which additional interim measures may occur.

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STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

1315 W. 4th Avenue • Kennewick, Washington 99336-6018 • (509) 735-7581

September 16, 1998

Mr. Marvin J. Furman
U.S. Department of Energy
P.O. Box 550, MSIN: HO-12
Richland, WA 99352

Dear Mr. Furman;

Re: Comments on "Results of Phase I Groundwater Quality Assessment for Single-Shell Tank Waste Management Areas S-SX at the Hanford Site" January 1998 (PNNL-11810)

The Washington State Department of Ecology (Ecology) has initiated its review of the above document. The number of comments generated thus far has prompted Ecology to provide you with the enclosed list of completed comments. Ecology believes this transmittal will give the U.S. Department of Energy (USDOE) and its contractors sufficient direction to begin revising the document. As can be observed from the enclosed comments, substantial editing of this document is necessary. Additional comments may be forthcoming as Ecology completes its review.

Ecology will also provide comments on the remaining Single-Shell Tank Groundwater Quality Assessments that USDOE has transmitted to Ecology. Ecology expects, however, that many of the issues identified in the enclosed comments will also be applicable to this other document.

If you have any questions, please contact Alex Stone (Storage) at (509) 736-3018 or Suzanne Dahl (Disposal) at (509) 736-5705.

Sincerely,

Suzanne Dahl
TWRS Disposal Project Manager
Nuclear Waste Program

Dr. Alex Stone
TWRS Disposal Project Manager
Nuclear Waste Program

SD:AS:sb
Enclosure

cc: Maureen Hunemuller, USDOE
Bob Lober, USDOE
Mike Thompson, USDOE
Doug Sherwood, EPA
Janice Williams, FDH
Dave Myers, LMHC
Jim Bertsch, MACTEC-ERS

Stuart Harris, CTUIR
Stan Sobczyk, NPT
Wade Riggsbee, YIN
Merilyn Reeves, HAB
Mary Lou Blazek, OOE
Administrative Record: SST TSD S-2-4 and
Vadose Zone Characterization

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**"Results of Phase I Groundwater Quality Assessment for Single-Shell Tank Waste
Management Areas S-SX at the Hanford Site" January 1998 (PNNL-11810)
Ecology Review Comments (July - August 1998)**

1. Page iii. Why reference FFCA? Does it set standards for RCRA phase 1? Please reference appropriate CFR and WAC.
2. Page iii, Summary, 1st paragraph. The term "Phase I" has no regulatory basis. Delete the term and insert the applicable regulatory citation. Recommended wording is: "Pacific Northwest National Laboratory conducted a "first determination" groundwater quality assessment for the U.S. Department of Energy, Richland Operations Office, in accordance with 40 CFR 265.93(d)(4) by reference of WAC 173-303-400(3)."
3. Page iii, Summary, 1st paragraph. It is recommended that an additional sentence be added to the first paragraph that reflects the regulatory status of the groundwater-monitoring program. Recommended wording is: "This report documents the first determination evaluation of 40 CFR 265.93(d)(4) and describes the assessment monitoring program of 40 CFR 265.93(7)(i)."
4. Page iii, Summary, 2nd paragraph. As Washington Administrative Code (WAC) 173-303-040 defines "ancillary equipment", insert the words "equipment and" between the words "ancillary" and "waste systems" in the first sentence.
5. Page iii, Summary, 2nd paragraph. The second sentence identifies the date the unit was "placed in the assessment groundwater monitoring program" as August 1996. A review of the downgradient groundwater data from RCRA and non-RCRA wells indicates groundwater contamination occurring as early as 1986. Therefore, it is recommended that the summary not identify that the assessment monitoring program was not initiated until August 1996. It is recommended the second sentence read "The unit is regulated under RCRA interim-status regulations (40 CFR, Subparts J and F, by reference of WAC 173-303-400(3)) and was placed in assessment groundwater monitoring (40 CFR 265.93(d)(4)) after elevated waste constituent and indicator parameter measurements/observations (i.e., specific conductivity, chromium, technetium-99, etc.) in S-SX WMA downgradient monitoring wells were repeatedly observed and confirmed."
6. Page iii, Summary, 2nd paragraph. The term "Phase I" has no regulatory basis. Delete the term in the last sentence of the paragraph and insert the applicable regulatory citation. Recommended wording is: "The first determination, allowed under 40 CFR 265.93(d), provides the owner-operator of a facility with an opportunity to demonstrate that the regulated unit is not the source of groundwater contamination."

7. Page iii, Summary, 3rd paragraph, 1st bullet. As the radionuclides represent constituents of the waste and "RCRA" is synonymous with "dangerous waste", recommended wording for the first sentence is: "Distribution patterns for waste constituents indicate the WMA S-SX has contributed to and/or been the source of groundwater contamination observed in downgradient monitoring wells."
8. Page iii, Summary, 3rd paragraph, 1st bullet. As the groundwater and vadose zone data is sufficient to make the first determination, recommended wording for the second sentence is: "It is concluded that multiple source locations in the WMA exist to explain the observed spatial and temporal groundwater contamination patterns."
9. Page iii, 2nd bullet: There is no "interim" drinking water standard in the regulation. Remove the word "interim".
10. Page iii, Summary, 3rd paragraph, 2nd and 3rd bullets. Due to the volume of data and the spatial and temporal groundwater contamination patterns observed thus far, the second and third bullets should be re-written to discuss just one constituent per bullet. In addition, due to the direction of groundwater flow and the location of the "RCRA" downgradient monitoring wells, the observations should not be limited to "RCRA" wells. The discussion should also not be limited to "current" observations. Many data exist which add value to the summary discussion. Some recommended wording is: "Drinking water standards for technetium-99 have been and currently are exceeded in S-SX WMA downgradient monitoring wells. Technetium-99 concentrations at well 299-W22-46, located at the southeastern corner of the SX tank farm, have been observed (from November 1996 to February 1998) to exceed the U.S. Environmental Protection Agency (EPA) interim drinking water standard (DWS) of 900 pCi/L up to a factor of five times. Technetium-99 concentrations at a non-RCRA well 299-W23-1 (located inside the S tank farm) have also been observed (from June 1986 to May 1998) to exceed the DWS up to a factor of nine times. Similarly, technetium-99 concentrations at another non-RCRA well 299-W23-7 (located northeast of the SX tank farm) have also been observed (from September 1987 to January 1991) to exceed the DWS up to a factor of eight times. Similarly, technetium-99 concentrations at another non-RCRA well 299-W23-2 (located inside the SX tank farm) have also been observed (from December 1987 to September 1994) to exceed the DWS up to a factor of 6 times. Technetium-99 concentrations at another RCRA well 299-W22-45 have recently been observed to be significantly increasing from previously measured concentrations (November 1992 to August 1996) to more than one-half the DWS (427 pCi/L on May 12, 1998)."
11. Page iii, Summary, 3rd paragraph, 2nd and 3rd bullets. Due to the volume of data and the spatial and temporal groundwater contamination patterns observed thus far, the second and third bullets should be re-written to discuss just one

constituent per bullet. In addition, due to the direction of groundwater flow and the location of the "RCRA" downgradient monitoring wells, the observations should not be limited to "RCRA" wells. The discussion should also not be limited to "current" observations. Many data exist which add value to the summary discussion. Some recommended wording is: "Drinking water standards of 10 mg/L for nitrate have been and currently are exceeded in S-SX WMA downgradient monitoring wells. Observations of nitrate concentrations at RCRA well 299-W22-46 have exceeded the DWS from 1992 to 1997 (data beyond November 1997 are currently unavailable) with what may appear to be a peak measurement in May 1997. Similarly, the DWS for nitrate has also been exceeded at RCRA downgradient well 299-W22-45 from 1995 to 1997. At this well, the nitrate measurements have consistently increased from February 1996 to November 1997. Similarly, the DWS for nitrate has also been exceeded at RCRA downgradient well 299-W22-39 from 1991 to 1996. At this well, little variation of nitrate concentration has been observed. The DWS for nitrate has also been exceeded at non-RCRA downgradient well 299-W23-2 (located within SX tank farm) from 1987 to 1996 (data beyond March 1996 unavailable) with a peak measurement in September 1994. Similarly, the DWS for nitrate has also been inconsistently exceeded at non-RCRA downgradient well 299-W23-3 (located at southeastern corner of and within SX tank farm) from 1957 to 1995 with a peak measurement in November 1961."

12. Page iii, Summary, 3rd paragraph, 2nd and 3rd bullets. Due to the volume of data and the spatial and temporal groundwater contamination patterns observed thus far, the second and third bullets should be re-written to discuss just one constituent per bullet. In addition, due to the direction of groundwater flow and the location of the "RCRA" downgradient monitoring wells, the observations should not be limited to "RCRA" wells. The discussion should also not be limited to "current" observations. Many data exist which add value to the summary to discuss. Some recommended wording is: "Drinking water standards of .05 mg/L for chromium have been exceeded in the RCRA downgradient wells 299-W22-39, 299-W22-44, and 299-W22-46 and in the non-RCRA downgradient well 299-W23-7. Due to the filtration of samples and in particular, the filtration of the most recent samples (typically from March 1994 to February 1998) a trend analysis cannot be performed."
13. Page iii, Summary, 3rd paragraph, 4th and 5th bullets. Due to the volume of data and the spatial and temporal groundwater contamination patterns observed thus far, the fourth and fifth bullets should be re-written to discuss all data available. In addition, due to the direction of groundwater flow and the location of the "RCRA" downgradient monitoring wells, the observations should not be limited to "RCRA" wells. Much data exists which add value to the summary discussion. Some recommended wording is: "Drinking water standards of 200 pCi/L for cesium-137 and 8 pCi/L for strontium-90 have not been exceeded in the RCRA or non-RCRA downgradient wells. Although concentrations of cesium-137 were

measured in well 299-W22-39 from November 1991 to July 1992, in well 299-W22-44 in October 1994, in well 299-W22-45 in April 1993, they have been low ranging from .52 to 6.5 pCi/L. The cesium-137 concentrations measured in non-RCRA well 299-W23-7 (located inside and between the S and SX tank farms) from September 1994 to June 1996 are an exception and ranged from relatively low values of 1.97 pCi/L to a high of 21.8 pCi/L. Similarly, strontium-90 concentrations have not been detected in any well with the exception of non-RCRA well 299-W23-7 from March 1996 to June 1996. In this well, strontium-90 concentrations have ranged from .869 to 6.153 pCi/L. With the exception of well 299-W23-7, these observations are consistent with the expected low mobility of these constituents under Hanford Site conditions. Additional investigation is needed to determine the extent of Cs-137 and Sr-90 contamination related to well 299-W23-7 observations."

14. Page iv, Paragraph 3 from preceding page, 3rd bullet. The term "Phase II" has no regulatory meaning. Recommended wording for the sentence is: "Further determinations required by 40 CFR 265.93(d)(7)(i) [by reference of WAC 173-303-400(3)] will be made and are described in Chapter 6 of this report."
15. Page iv, last bullet: Phase II investigation should include nature and extent and sources of contamination within groundwater and vadose zone.
16. Page 1.1, Section 1.0, 1st paragraph. The term "Phase I" in the first sentence has no regulatory meaning. Also, the report should cite the applicability of the Washington Administrative Code. Recommended wording is: "This report presents the findings and conclusions of the first determination, *Resource Conservation and Recovery Act of 1976* (RCRA) groundwater quality assessment of Single Shell Tank Waste Management Area (WMA) S-SX as required by 40 CFR 265.93(d) (by reference of WAC 173-303-400(3))."
17. Page 1.1, Section 1.0, 1st paragraph. Due to the considerable volume of data and information which may precede PNNL's efforts which occurred from August 1996 to July 1997, it is appropriate to also identify the data considered during the assessment includes all useable data from all wells. In other words, certain (non-RCRA) wells were installed much earlier than the stated assessment period and meaningful information can be obtained from the consideration of the data collected prior to August 1996. Therefore, the period should at least be inclusive of the time when contamination was first detected in a downgradient monitoring well. For example, from well 299-W23-7, significantly elevated gross beta was measured in June 1987 and grossly elevated technetium-99 was measured in September 1987. Similarly, from well 299-W23-1, elevated gross beta was measured in March 1959 and grossly elevated technetium-99 was measured in June 1986. It should be noted that technetium-99 for well 299-W23-1 was first measured on June 23, 1986. Related to the most recent data used, as Ecology has taken more than six months to review this document, it is requested the data

period be extended to December 1998. Therefore, recommended wording for the second sentence is: "Pacific Northwest National Laboratory conducted the assessment from August 1996 to July 1997 using data collected between the early 1970's and December 1998.

18. Page 1.1, Section 1.0, 1st paragraph, 2nd bullet. For consistency with WAC 173-303-040, insert the words "equipment and" between "ancillary" and "waste systems".
19. Page 1.1, Section 1.1. Please note that these active TSD units are not in compliance with RCRA and appropriate WAC Code, but are allowed active status under the Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement).
20. Page 1.1, Section 1.1. Nature of extent contamination determination is not just within groundwater, but also the vadose zone.
21. Page 1.1, Section 1.1, 1st paragraph. Include the applicable regulatory cite for management of the tanks. Recommended wording is: "The tanks and ancillary equipment in WMA S-SX are RCRA treatment and storage units managed in accordance with Title 40, Code of Federal Regulation (CFR) Part 265, Subparts F and J (40 CFR 265.92 and 265.196 [by reference of Washington Administrative Code (WAC) 173-303-400(3)]. In addition, the units will be closed in accordance with WAC 173-303-610."
22. Page 1.1, Section 1.1, 2nd paragraph. The term "detection monitoring program" is typically used in reference to final facility status monitoring program for which no contamination from the regulated unit has been detected. Change "A detection-level groundwater monitoring program" to "An indicator parameter monitoring program".
23. Page 1.1, Section 1.1, 2nd paragraph. As groundwater monitoring occurred for WMA S-SX long before 1990, insert the word "administratively" between "was" and "initiated" in the first sentence.
24. Page 1.1, Section 1.1, 2nd paragraph. As the assessment-monitoring program could have been initiated much earlier than 1996, insert the word "administratively" between "was" and "placed" in the second sentence. Also, identify which WMA tank system unit Ecology's 1996 directive was addressing.
25. Page 1.1, Section 1.1, 3rd paragraph. There is no regulatory basis for the term "Phase I". In addition, the first sentence is describing how the regulations are typically applied. For reasons, perhaps not beneficial to describe, the WMA S-SX unit's initiation of assessment monitoring was incorrectly delayed. Similarly, the unit's first determination may be considered to have been performed over an

extended duration. Recommended wording for the first sentence is: "The first determination, and the subject of this report, is typically a short-term sampling program intended to provide the owner/operator an opportunity to substantiate a false positive claim."

26. Page 1.1, Section 1.1, 3rd paragraph. Re-write the second sentence as: "If the owner/operator determines, based on the results of the first determination, that no dangerous waste and/or dangerous waste constituents from the unit have entered the groundwater, then he may reinstate the indicator parameter monitoring program (40 CFR 265.93(d)(6))."
27. Page 1.1, Section 1.1, 3rd paragraph. Re-write the third sentence as: "If, however, contamination is confirmed (i.e., the regulated unit is the source of groundwater contamination), then further determinations are required under 40 CFR 265.93(d)(7)(i)."
28. Page 1.1, Section 1.1, 3rd paragraph. Re-write the fourth sentence as: "In addition, information gained during the assessment monitoring program (including the further determinations), could be used to evaluate corrective measures."
29. Figures 1.1, 1.2, 3.6, and 3.7. The figures don't appear to include pertinent ancillary equipment. In particular, at least one figure should show where unplanned releases have occurred in relation to the management of the S-SX tanks and/or ancillary equipment. For example, as an unplanned release occurred around the 241-S-151 diversion box, this area denoted on a figure would provide pertinent information to this assessment. Table 3 of *Vadose Zone Characterization Project at the Hanford Tank Farms SX Tank Farm Report* (DOE/ID/12584 GJPO-HAN-4, September 1996) describes unplanned releases associated with the management of the SX tank farm and Figure 2 of the same report identifies the locations of more than a dozen releases.
30. Figure 1.2. A comparison of the well numbers shown on Figure 1.2 and the wells described in Appendix D of *Assessment Groundwater Monitoring Plan for Single Shell Tank Waste management area S-SX* (WHC-SD-EN-AP-191, Rev. 0) was performed. The referenced document identifies well numbers 299-W22-6, 299-W22-16, and 299-W23-8, which do not appear to be shown on Figure 1.2. Well number confirmation and inclusion on Figure 1.2, if applicable, is requested.
31. Figure 1.2. Figure 2 of *Vadose Zone Characterization Project at the Hanford Tank Farms SX Tank Farm Report*, September 1996, DOE/ID/12584-268 GJPO-HAN-4, shows 216-S-8 trench located just northeast of tank 104. Figure 1.2 shows 216-S-8 trench located southeast of tank 104. Similarly, Figure 1.2 shows well 299-W22-39 located just west of 216-S-8 trench and Figure 2 shows well

299-W22-39 located approximately 200 feet south of 216-S-8 trench. Confirm the accuracy of Figure 2's location of 216-S-8 trench and well 299-W22-39.

32. Page 1.3, Section 1.2, 1st paragraph. In the first sentence, include the identification that observed contamination concentrations were also considered. Recommended wording is: "...if observed concentrations of contaminants and changes in groundwater quality....".
33. Page 1.3, Section 1.2, 1st paragraph. Change "Phase I" to "first determination" in the second sentence.
34. Page 1.3, Section 1.2, 2nd paragraph. As this report represents the first determination of the assessment monitoring program, it should not be limited to a description of "new information". Recommended wording for the first sentence is: "The scope of this report focuses on new information acquired in connection with the first determination assessment."
35. Page 1.3, Section 1.3, 1st paragraph. Change "Phase I" to "first determination" in the first sentence.
36. Page 2.1, Section 2.0, 1st paragraph. Change "Phase I" to "first determination" in the first sentence.
37. Page 2.1, Section 2.0, 1st paragraph. The use of a DQO process is described whereby a conceptual model will be generated as the investigation continues. The second sentence of this paragraph should be moved to Chapter 6 of this document. The further determination actions (required by 40 CFR 165.93(d)(7)(i)) should be described in detail in Chapter 6.
38. Page 2.1, Section 2.0, 2nd paragraph. Change "Phase I" to "first determination" in the first sentence.
39. Page 2.1, Section 2.1.1. What Does CWR stand for?
40. Page 2.5, Section 2.2. Please discuss the leak volumes for S/SX tank farm. Also, add a discussion of the Agnew report on the underestimation of releases from this tank farm.
41. Pages 2.5-2.5, Section 2.2. Section 3.8 (page 3.18) appears to describe contaminant transport as a plume. The vadose zone characterization information from BX, BY, TX, TY, T and SX suggests that contamination has moved as broad, low-activity plumes. While Section 3.8 appears to be describing this conceptualization, it does not do so clearly. Similarly, Section 2.2 does not appear to include this conceptualization, but rather, it emphasizes the non-homogeneous nature of the sedimentary units beneath the units as playing an

important role in contaminant movement. Similarly, Figures 3.9 and 3.10 emphasize this concept by implying the stratigraphic layers control contaminant transport. Include a conceptualization of plume migration in a relatively homogeneous fashion. It should be noted that this concept does not negate, but rather compliments, the expert panel's concept. The voluminous vadose zone characterization information may be referenced in relation to the "relatively" homogenous plume migration concept.

42. Page 2.4, Section 2.1.1, 3rd and 6th paragraphs. Figure 1.2 is identified as showing SX tank farm leakers but does not appear to identify designated leakers. Figure 3.6 shows designated leakers and would be a better figure to reference.
43. Page 2.4, Section 2.1.1, 6th paragraph. Delete the word "potential" in the first sentence, as there is no question that groundwater beneath the S-SX WMA has been and remains contaminated.
44. Page 2.4, Section 2.1.1, 6th paragraph. Although considerable vadose zone characterization information has been documented, only two DOE reports are referenced in the last sentence of the paragraph. The following additional reports/documents should also be referenced and/or discussed in this assessment: 1) *Tank Summary Data Report for Tank SX-102*, October 1995 (GJ-HAN-6, Tank SX-102), 2) *Tank Summary Data Report for Tank SX-108*, November 1995 (GJ-HAN-10, Tank SX-108), 3) *Tank Summary Data Report for Tank SX-109*, December 1995 (GJ-HAN-11, Tank SX-109), 4) *Tank Summary Data Report for Tank SX-110*, December 1995 (GJ-HAN-12, Tank SX-110), 5) *Tank Summary Data Report for Tank SX-110*, December 1995 (GJ-HAN-13, Tank SX-111), 6) *Tank Summary Data Report for Tank SX-115*, January 1996, (GJ-HAN-17, Tank SX-115), 7) *Assessment of Log Data for Borehole 41-09-39 and Correlation With Borehole 41-09-04 in the SX Tank Farm*, March 1997 (GJO-97-4-TAR, GJO-HAN-9) and 8) *Reassessment of the Vadose Zone Contamination at Tank SX-104 and a Comparison to the 1995 Baseline*, April 1998 (GJO-98-48-TAR, GJO-HAN-21).
45. Page 2.5, Section 2.1.1, paragraph from preceding page. Insert "groundwater and/or" between "contributors to" and "vadose zone contamination" in the first complete sentence on the page.
46. Page 2.5, Section 2.1.2, 1st and 2nd paragraphs. The possible dissolution and precipitation of silica and aluminum in the soil column is discussed/described. An identification of an unusually high silica percentage in drill cuttings (at depth) has not been made. Include the identification of all applicable observations from drill cuttings (i.e., the observation(s) of the occurrence of high silica content, the observation(s) of occurrence of average silica content, and/or the observation(s) of low silica content). It is noted that the proposed activities as described in the *Assessment Groundwater Monitoring Plan for Single Shell Tank Waste*

management Area S-SX (WHC-SD-EN-AP-191, Rev. 0) do not appear to specifically collect silica content observations. Nonetheless, if observations were made, include them and if no observations were made, include the identification of this status.

47. Page 2, Section 2.1.2, First and second paragraph. It is an established fact that multi-molar high caustic liquids dissolve silica and aluminum. Under vadose conditions, we should expect precipitation of these materials at depth (silica nodules, colloidal silica, silica as binding cement, etc.). Did we observe any unusually high silica percentages in drill cuttings at depth? If this was not observed, it is highly probable that the entire mass of tank leakage have moved downward as a wetting front. This wetting front need not necessarily be as broad as mentioned in the text.
48. Page 2.5, Section 2.1.2, 2nd paragraph. Identify the basis for the descriptor "broad" used in the first sentence in relation to the "wetting front". The basis should be included in the text discussion.
49. Page 2.2, Figure 2.1. While the conceptualized model of contaminant transport through the soil to the groundwater correctly identifies contaminated groundwater, which satisfies the purpose of the first determination, it appears the model is greatly simplified. Although the model is identified as representing spills/leakage during the 1960's (with subsequent movement of contaminants shown in single colors based on the likely rate of transport through the soil), it does not communicate that there have been numerous releases in and around the S-SX WMA beginning in the 1950's to the last documented unplanned release in 1980. While it is accurate to depict groundwater contamination of mobile constituents, less mobile constituents have also been observed in groundwater. In particular, cesium-137 and strontium-90 have been measured numerous times in the groundwater at several locations. In addition, the contaminant transport is greatly complicated by the potential complex geochemical reactions occurring in the subsurface, the complex configuration of tank ancillary equipment, numerous spills and/or leaks which have occurred in and near the S-SX WMA, etc. Perhaps the most deficient aspect about the conceptualized model is that it doesn't accurately depict that releases have occurred numerous times and each time potentially re-starting and/or promoting contaminant transport. Using overlays that depict the passage of time and new occurrences may best depict such a re-occurring contaminant front moving through the vadose and into the groundwater. At a minimum, the figure must identify that the conceptualized model is a simplified one that only depicts one potential "generation" of contaminant transport through the vadose zone.
50. Page 2.5, Section 2.1.2, 4th paragraph. Insert the words "(S-SX tank system ancillary equipment) between "outlets of the tanks" and "also contributed to".

51. Page 2.6, Section 2.2, 1st full paragraph. The second sentence states "five wells were drilled to groundwater in the S and SX farms, three of which are adjacent to tanks". According to Figure 1.2 and information contained in the *Assessment Groundwater Monitoring Plan for Single Shell Tank Waste management Area S-SX* (WHC-SD-EN-AP-191, Rev. 0), there are six groundwater wells in the S and SX farms, four of which are adjacent to tanks.
52. Page 2.6, Section 2.3, 1st paragraph. Change the wording in the first sentence to include spills and leaks of water and/or wastes. Recommended wording is: "...or a leak and/or spill (water and/or waste) of sufficient....".
53. Page 2.6, Section 2.4, 1st paragraph. Change the word "co-contaminants" to "constituents" in the second sentence.
54. Page 2.6, Section 2.4, 1st paragraph. Insert "While radionuclide constituents contribute to the toxic dangerous waste designation," at the beginning of the sentence. In addition, change "hazardous waste constituents (or listed wastes)" to "toxicity characteristic contaminants" in the third sentence. Recommended wording for the third sentence is: "While radionuclide constituents contribute to the toxic dangerous waste designation, the latter two constituents are RCRA toxicity characteristic contaminants."
55. Page 2.6, Section 2.4, 1st paragraph. The fourth sentence implies that past-practice discharges of tritium-bearing tank condensate have occurred upgradient from all S-SX WMA groundwater monitoring wells. From information available, it appears the tritium-releasing unit of reference is the 216-S-25 crib. It may be concluded that the crib is directly upgradient from the SX tank farm and upgradient from only part of the S tank farm. Therefore, recommended wording for the fourth sentence is the following: "Tritium also is present in the tank waste, but a much larger tritium source (past-practice tritium-bearing tank condensate discharges to 216-S-25 crib) has been located directly upgradient from the SX tank farm (*Hanford Site Groundwater Monitoring for Fiscal Year 1997*, Plate 3).
56. Page 2.6, Section 2.4, 1st paragraph. It is noted that 216-S-25 crib is directly upgradient from SX tank farm and upgradient from only part of S tank farm. The tritium plots for the 1995, 1996, and 1997 Hanford Site groundwater monitoring reports (Plate 3) appear to be indicating an upward tritium trend in the area near well 299-W23-1. The same upward trend does not appear to be observed near upgradient well 299-W23-13 (located between upgradient tritium source 216-S-21 and S-SX WMA). As such, include a discussion of the tritium plume, the tritium to technetium-99 ratios, and the expectations associated with the hydraulic conductivity at well 299-W23-1. In particular, if there is a basis for the implied groundwater flow direction perturbation, include the basis.

57. Page 2.7, Section 2.4, 1st paragraph. Change the word "co-contaminants" to "constituents" in the first sentence.
58. Chapter 3. A section, which describes the groundwater monitoring network, should be inserted into this report. While it is appropriate to reference previously published documents for detailed information (i.e., *Assessment Groundwater Monitoring Plan for Single Shell Tank Waste management Area S-SX* (WHC-SD-EN-AP-191, Rev. 0), without discussion and/or explanation, various erroneous conclusions may be drawn from the report. For example, considering certain text, figures and plots provided in the report, it appears to imply that monitoring well 299-W22-44 is "downgradient" to the S-SX WMA. While certain figures clearly show the expected path of groundwater plume migration (Figure 4.1) to be away from well 299-W22-44, other figures imply the well is downgradient (Figures 3.1 and 3.3). It is noted that well 299-W22-44 would not satisfy compliance point monitoring of WAC 173-303-645. Similarly, monitoring well 299-W23-15 could be considered to monitor only the southwestern-most corner of the S-SX WMA. While Figures 4.1 and 4.2 show plausible hypothetical groundwater plumes to explain the observations from well 299-W23-15, a description of the groundwater monitoring network which more clearly identifies what areas (spills and/or releases) and which tanks/ancillary equipment the monitoring wells are "monitoring" is very much needed in this chapter.
59. Page 3.1, Section 3.0, 1st paragraph. Delete the term "Phase I" and replace it with "first determination".
60. Page 3.1, Section 3.0, 1st paragraph. Although the contractor was contracted to perform work from August 1996 to 1997, it is Ecology's position that statistical exceedances (between up- and down-gradient wells) have been occurring since 1991 (Ecology, May 24, 1996). Therefore, the first determination may be concluded to have been occurring well before August 1996. Either delete "(August 1996 to August 1997)" or replace it with "(1991-1998)".
61. Page 3.1, Section 3.1, title of section. Change the word "co-contaminant" to "waste constituent".
62. Page 3.1, Section 3.1. Include an identification that groundwater samples have been filtered since early 1995. Describe the filtration process. Also, include a discussion of how filtration typically lowers the measurement of metallic ion concentrations. It is noted that all chromium drinking water exceedances (from wells 299-W23-14, 299-W22-39, 299-W23-15, 299-W22-44, 299-W22-45, and 299-W23-1 which occurred from 1991 to present were unfiltered samples.
63. Page 3.1, Section 3.1, 1st paragraph. Change the word "co-contaminants" to "constituents" in the first sentence.

64. Page 3.1, Section 3.1, 2nd paragraph. Tanks SX-108 and 109 are indicated as "the primary single-shell tank leak sources". As there is a history of spills and releases from other tanks in the SX tank farm, the basis for this particular statement must be included.
65. Page 3.1, Section 3.1, 2nd paragraph. Due to the significance associated with data collected by bailing versus purge and pump, include an appendix to the report that identifies how the various wells were sampled.
66. Page 3.1, Section 3.1, 3rd paragraph. Well 299-W23-1 is noted in the last paragraph as the only well in the vicinity of WMA S-SX currently showing an upward trend. Include an identification that an upward tritium trend has been observed at wells 299-W23-1, 299-W22-39, and 299-W22-45. An upward tritium trend has been observed at well 299-W22-39 since March 1994.
67. Page 3.1, Section 3.2, 1st paragraph. Change the word "co-contaminants" to "constituents" in the first sentence.
68. Page 3.4, Section 3.2. In a short summary, state what is the point of this section as it specifically relates to S/SX.
69. Page 3.4, Section 3.3, Figure 3.3. Include plots for tritium data collected from wells 299-W23-13 and 299-W23-1.
70. Page 3.4, Section 3.3. Add a discussion of tritium observations (upward trend in downgradient wells) from wells 299-W23-13, 299-W23-1, 299-W22-39, and 299-W22-46. The tritium plots for the 1995, 1996, and 1997 Hanford Site groundwater monitoring reports (Plate 3) appear to be indicating an upward tritium trend in the area near well 299-W23-1.
71. Page 3.6, Section 3.4. It is recommended that concentration contours maps for tritium and technetium-99 for fiscal years '95 and '96 are added to the report.
72. Page 3.5, Section 3.4, 3rd paragraph. The first sentence states the source areas for tritium and technetium-99 are clearly evident. Due to the '95, '96, and '97 Hanford Site groundwater monitoring reports (Plate 3) which show a trending tritium plume occurring in the north-eastern side of the S-SX WMA, include an explanatory basis for this statement.
73. Page 3.5, Section 3.4, 3rd paragraph. Delete the word "appears" in the second sentence. Recommended wording is: "Groundwater monitoring observations strongly suggest technetium-99 originates in the S and SX tank farm area while the highest concentrations of tritium originate to the west of the WMA near the upgradient crib sources noted above."

74. Page 3.5, Section 3.4, 3rd paragraph. The third sentence identifies other major downgradient sources and the fourth sentence provides an example of a sidegradient source. Recommended wording is: "It should also be noted that other major down- and side-gradient sources exist, especially for technetium-99. For example, the technetium-99 contours near the upper right corner of Figure 3.4 originated from side-gradient past-practice disposal sites associated with U Plant operations."
75. Page 3.5, Section 3.4, 4th and 5th paragraphs. The paragraphs do not appear to make any conclusions regarding the tritium observations. From Figure 3.5, it may be inferred that there are two different sources. Therefore, it may also be inferred that there are two different sources of the technetium-99 and the tritium. Include a discussion of the observations related to the tritium trend in the northeastern area of the S-SX WMA.
76. Page 3.5, Section 3.4, 5th paragraph. As the source of the technetium-99 has not been remediated, delete "(or was)" in the last sentence of the paragraph.
77. Figure 3.5. Upon review, the figure represents a useful generalization of observations. The text describing the figure indicates the data are an average of 1996 values for 12 wells. Considering the locations of the 12 data points and the statistical variation associated with the averaging (i.e., spatial and temporal), it is more accurate, at this time, to describe the information as representing a generalized relationship. In addition, it is indicated on page 3.5 that the expected tritium/technetium-99 ratio in downgradient wells is based upon "data and considerations provided in Agnew (1997)". Again, considering the potential error associated with the Agnew information, it is appropriate to describe the observed relationships as generalized and are to be evaluated/confirmed with additional data.
78. Figure 3.5. Figure 3.5 identifies data from well 299-W22-21 was used in its construction. Figure 1.2 does not appear to show this well. Include the well location on Figure 1.2.
79. Figure 3.5. The figure appears to include a data point for well 299-W22-10. According to Figure 1.2, this well appears to be downgradient to the 216-S-1,2 crib. Confirm if the well number is correctly indicated on Figure 3.5.
80. Figure 3.5. The data from well 299-W23-1 does not appear to be included in the plot. Include this well on the plot.
81. Figure 3.5. The data, if any exists, from well 299-W23-5, does not appear to have been included on the plot. If data exists for well 299-W23-5, include it on the plot.

82. Page 3.9, Section 3.5.1, 1st paragraph. The report does not appear to include hydrographs or data to explain the statement made in the second sentence concerning the declining water table. Include either data or hydrographs that reflect this information.
83. Page 3.9, Section 3.5.1, 1st paragraph. The issue associated with the declining water table and the requirement to perform further assessments of the contamination (40 CFR 265.93(d)(7)(i) by reference of WAC 173-303-400) will need to be resolved. It does not appear that an evaluation of the rate of decline (i.e., the remaining well life) has been performed. Include an evaluation in this section of the report.
84. Page 3.9, Section 3.5.1: There seems to be large variability in the tritium values as evidenced from the table. An explanation is required to define this anomaly. There are other constituents, which also show some anomaly (e.g. nitrate and Cs). Whatever the anomaly, it is important to note that this data is for samples taken within 7 feet of the surface. Do you have any idea what is going on at greater depth?
85. Page 3.9, Section 3.5.2. The discussion identifies 'the net effect is for significant retention of cesium-137 and strontium-90 in the vadose zone and/or on aquifer solids.' It is also noted that a tremendously large amount of information and data exist regarding the Cs-137 and Sr-90 vadose zone contamination. Therefore, include an identification in this section that Cs-137 and Sr-90 contamination has been confirmed in the vadose zone. In addition, include a reference in this section which identifies the Cs-137 and Sr-90 vadose zone contamination will be discussed in detail in Section 3.7 of this report.
86. Page 3.10, Table 3.1. The table's measured concentration for I-129 is indicated as 'NA' or not available. The HEIS database, however, indicates that sampling occurred and the results indicated values were below the detection limit of the analysis. Please update the table to reflect the 'less than detection limits' reported in HEIS.
87. Page 3.10, Table 3.1. The HEIS data indicates a May 23, 1997 tritium measurement of 64400 pCi/L. Although it is unknown if the measurement was from the "normal" or "shallow" sampling depth, the measurement is not reflected in the table. Please explain this discrepancy.
88. Page 3.11, Section 3.5.2, Top of the page: The alternative theory is not clear. The salt matrix is supposed to cover the clay surfaces and would effect the K_d values - a phenomenon expected to occur mostly in the vadose zone (under the defined scenario). Please clarify the details of the alternative theory and explain its impact on the discussion.

89. Page 3.11, Section 3.6: Although tritium plumes can substantiate to some extent the hydraulic conductivity information as presented in the figure, the other data (e.g. Tc-99) does not to support the conclusion. A superimposed plot of hydraulic conductivity and plume maps would clarify some of the conclusion made in this report. For example, it appears the mixture of hypothetical plumes of Tc-99 from tank leak and spill may occur closer to the Tank Farm (Figure 4.1) than depicted. Please clarify the language in this section to respond to these issues.
90. Page 3.13, Figure 3.8. On page 3.11 Figure 3.8 is based on information/data dating to or before 1992. If pump test data exists from newer boreholes, use all of the data to update this figure (i.e., to evaluate permeability variation).
91. Page 3.14-3.17, Section 3.7.2: It is not clear why the near surface gravel layer or deeper gravel layer (which is at/close to the water table) under the depicted scenario should act as conduit for lateral migration. In most cases the tanks are on top of the gravel layer. Some lateral migration might take place at the boundary of gravel layer and sand. This is unlikely since the conductivities and porosities are usually higher in sand than gravel. Does any field data exist to substantiate the premise in this section? If so, include the data and a more detailed explanation of the phenomena.
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Was any perched water encountered (or very high soil moisture near the surface gravel layer, etc.)? From the observation of numerous crib (CERCLA) sites where millions of gallons of waste were discharged to the soil column, there is no evidence of having a perched water table or any similar hydrogeologic phenomenon close to the surface in the 200 Area. Include a discussion of these issues in this section.

92. Page 3.14, Section 3.7.1, 2nd paragraph. Include the actual measured concentrations of borehole 41-09-39 in the discussion particularly as it relates to the statement that concentrations were 1,000 to 10,000 times lower than maximum concentrations that occur above the gravel sequence. The last part of this paragraph is not clear. What do you mean by increase of likelihood of breakthrough to ground water? When you pump groundwater, you increase the vadose thickness and capillary fringe zone (shifting) above the water table. This section needs clarification.
93. Page 3.14, Section 3.7.1, 2nd paragraph. Initial groundwater samples at the top of the aquifer indicate hexavalent chromium is non-detectable (<10 µg/L) from borehole 41-09-39. It is not indicated whether or not the samples were filtered. The groundwater data as identified in HEIS indicates the groundwater samples for chromium have been filtered (wells 299-W22-46, 299-W22-39, 299-W22-45, 299-W23-15, and 299-W23-14) since early 1994. In addition, chromium concentrations measured at well 299-W23-7 in June 1996 were unfiltered and

exceeded (53 µg/L) the chromium drinking water standard (.05 mg/L). Similarly, chromium concentrations measured at well 299-W22-39 in November 1991, January 1992, July 1992, November 1992, June 1993, and March 1994 were unfiltered and exceeded (60, 83, 380, 100, 160, and 200 µg/L respectively) the chromium drinking water standard. Similarly, chromium concentrations measured at well 299-W22-46 in July 1992, November 1992, March 1993, June 1993, and March 1994 were unfiltered and exceeded (72, 70, 120, 130, and 120 µg/L respectively) the chromium drinking water standard. Therefore, identify if the sample(s) from borehole 41-09-39 were filtered. If filtered, include a discussion regarding the above observations including general conclusions of the effect of filtration related to ion measurements.

94. Pages 3.15 and 3.16, Figures 3.9 and 3.10. Figure 3.9 depicts contamination above 1 pCi/g and Figure 3.10 depicts contamination above 10 pCi/g. Due to the voluminous vadose zone characterization information available, the figures must either be redrawn to depict detectable low-level contamination below 1 pCi/g or provide a technical basis which justifies the non-importance of understanding low-level contamination in relation to the physical and chemical mechanisms of contaminant transport. Similarly, Figure 3.10 must be redrawn to include Cs-137 measurements above 10,000 pCi/g. The re-drawing should depict the high levels of contamination measured at boreholes 41-07-07, 41-09-09, and 41-00-08.
95. Pages 3.15 and 3.16, Figures 3.9 and 3.10. The figures depict a contamination perching effect occurring above the gravel and sandy gravel layers. The figures tend to depict the gravel and sandy gravel layers as conduits for lateral migration. While some degree of lateral migration may occur at such interface changes, the figures imply a relatively significant stratigraphic control. Include the basis for these interpretations (i.e., contaminant concentrations and/or moisture content measurements, perched water observations during drilling, etc.).
96. Pages 3.16, Figure 3.10. Figure 3.10 does not appear to include data from borehole 41-09-09. Either include this borehole data or provide justification for its exclusion.
97. Page 3.14, Section 3.7.2, 1st paragraph. After Figure 3.10 is re-drawn to reflect additional contamination data, include an identification that the postulated stratigraphic control near tank S-104 is not as highly correlated as expected.
98. Page 3.17, Section 3.7.3 Please discuss the increased amount infiltration in non-vegetated gravel tank farms. Discuss also the increase in infiltration due to umbrella effect of tank impervious domes. Increased impervious area concentrates recharge between tanks.

99. Page 3.17, Section 3.7.3, 2nd paragraph: There seems to be noticeable differences in soil moisture between shallow and deeper parts in certain wells (section AA, wells W23-14, and W22-39). Explain the observation.
100. Page 3.18, Section 3.8. Include an identification that the circumstantial evidence being referred to is the interpretation of data as depicted in Figures 3.9 and 3.10 which appears to be primarily based upon the contamination measured at borehole 41-09-39. This section should also include an identification that there is also considerably more circumstantial evidence that indicates there are numerous regions of "deep" contamination at the SX tank farm. This section should also identify that borehole 41-09-39 represents the deepest borehole from which vadose zone characterization information has been obtained and the vertical plume depicted in Figure 3.10 may largely be due to the lack of additional deep vadose zone data. This section should include a conclusion that it is not known at this time if the contamination is primarily transported via small vertical structures or if it occurs as a relatively large homogeneous plume.
101. Page 3.18, Section 3.8: Recently, PNNL has collected a lot of information and values on K_d s of a number of compounds/analytes that are more reasonable to use under different conditions. Use these values for consistency and accuracy.
102. Section 3.8. The section discusses technetium-99, cesium-137 and strontium-90 in relation to contaminant breakthrough. Although the chemical constituents are discussed in relation to analytical results in Appendix B, Section 3.8 does not reference the Appendix B constituents as contaminants which have been detected in the groundwater. In addition, Appendix B only contains data from '96 to '97, although much more data exists. Furthermore, pre-1996 groundwater data has been used in several sections of the document to discuss constituent patterns and relationships. Therefore, include a discussion of groundwater contaminant observations.

Aluminum represents an example of a groundwater constituent that should be discussed in the report. The HEIS data indicates aluminum concentrations have been measured since 1987. Aluminum observations range from non-detect (approximately 20 µg/L) to 13,000 µg/L (March 1994) and 18,300 µg/L (May 1997). From the HEIS entries, it appears groundwater samples were filtered beginning March 1994. With a few exceptions, filtered aluminum concentrations have been non-detect to relatively low compared to the non-filtered concentrations. The filtered groundwater samples may generally be described as resulting in aluminum measurements that are typically more than an order of magnitude lower than the non-filtered groundwater samples. In conclusion, the aluminum summary provided in Appendix B of the report incorrectly identifies that most of the aluminum results "are at or near detection limit". Describe all of

the data and include a trend analysis of non-filtered aluminum measurements, if applicable.

Carbon tetrachloride also represents an example of a groundwater constituent occurring in the S-SX WMA monitoring wells that should be discussed in the report. The HEIS data indicates carbon tetrachloride concentrations have been measured since 1992 at both up and downgradient S-SX WMA groundwater monitoring wells. Although measurements were not made consistently (from the same wells or at the same frequency), the observations collected thus far indicate that concentrations of carbon tetrachloride in downgradient wells have been greater than the respective concentrations observed in upgradient well 299-W-14 on at least two occasions (it should also be noted that carbon tetrachloride concentrations in upgradient well 299-W23-14 have only been measured four times since 1992). Furthermore, water quality standards for groundwater as established by WAC 173-200 for carbon tetrachloride ($.3 \mu\text{g/L}$) have been exceeded since 1997 by two orders of magnitude in well 299-W23-15. Carbon tetrachloride measurements as recorded in the Tank Waste Information Network System (TWINS) indicate that of the two tank farms (S and SX), only samples/cores from one tank (S-104) have been analyzed for carbon tetrachloride. Review of the core sample data indicates carbon tetrachloride was not detected. Similarly, TWINS data for vapor analyses indicates carbon tetrachloride was detected in the tank vapor headspace of tanks S-102 and S-106. It should be noted that the review of the TWINS data indicates that the vapor headspace of only seven tanks (SX-1, S-101, S-102, S-103, S-106, S-111, and S-112) were analyzed. A further review of the HEIS data has indicated that carbon tetrachloride has also been found in the 216-S-25 crib groundwater monitoring wells. The data also indicates the first 216-S-25 crib carbon tetrachloride observation occurred in July 1993 ($1.2 \mu\text{g/L}$) at well 299-W23-10. In comparison, the data indicates the first S-SX WMA carbon tetrachloride observation occurred in January 1992 ($2.9 \mu\text{g/L}$). Therefore, the report must include a discussion of carbon tetrachloride observations from the S-SX WMA and 216-S-25 crib groundwater monitoring network wells. In addition, the discussion should include the TWINS data base information regarding carbon tetrachloride analyses with an indication of which tank wastes and/or headspaces were sampled. In addition, if vadose zone carbon tetrachloride data exists, that data should also be included in the discussion.

Nitrate, potassium, and fluoride should also be discussed in this report. In particular, it is appropriate to statistically compare the upgradient to the downgradient concentrations.

103. Page 4.1, Section 4.1, 1st paragraph. Delete the term "Phase I" as it has no regulatory meaning. Recommended wording for the first sentence is: "As part of this first determination groundwater assessment, an attempt..."

104. Page 4.1, Section 4.1, 1st paragraph. As more hypothetical scenarios exist to explain the contamination observations, recommended wording for the second sentence is: "For this purpose, the following three scenarios are considered:".
105. Page 4.1, Section 4.1.1, 1st paragraph. Identify that the "SX Tank Farm Report" (DOE/ID/12584-268, GJPO-HAN-4, September 1996) tank-by-tank vadose zone characterization discussions (Section 10.2) do not support this scenario. It should also note that the report identifies substantial surface contamination above most SX tanks, which does not appear to be addressed by this scenario.
106. Page 4.1, Section 4.1.2, 1st paragraph. Identify that the "SX Tank Farm Report" (DOE/ID/12584-268, GJPO-HAN-4, September 1996) tank-by-tank vadose zone characterization discussions (Section 10.2) do not support this scenario. It should also note that the report identifies substantial surface contamination above most SX tanks, which does not appear to be addressed by this scenario.
107. Page 4.3, Section 4.1.3, 1st paragraph. Identify that the "SX Tank Farm Report" (DOE/ID/12584-268, GJPO-HAN-4, September 1996) tank-by-tank vadose zone characterization discussions (Section 10.2) do not support this scenario. It should also note that the report identifies substantial surface contamination above most SX tanks, which does not appear to be addressed by this scenario.
108. Page 4.5, Section 4.2.1, 2nd paragraph. Identify the potential pore volume associated with utility line leakage. From the discussion occurring in Section 4.2.2, line leakage may easily represent multiple pore volumes. Recommended wording to add to the end of the second paragraph is: "It should be noted that this comparison does not include consideration of utility line leakage."
109. Page 4.5, Section 4.2.2, 1st paragraph. The last sentence indicates a high potential for a significant volume of utility line leakage. If records and/or estimates of volumes associated with this practice exist, they should be included as an appendix to this report.
110. Pages 4.5 - 4.9, Section 4.2.2. The discussion of utility line leakage and the comparison to specific conductivity observations is particularly important 1) in understanding contaminant transport and 2) for identifying objectives associated with future monitoring of the contamination plumes.

The first full paragraph on page 4.7 describes an eight-foot cottonwood tree and Figure 4.4 provides a photograph of the tree flourishing among the sagebrush. From this information, an approximation of the age of the tree and the water required for the tree to survive may be made. It is requested that these approximations be included in the report.

Specific conductivity as an indicator parameter should be discussed and/or analyzed in more detail. The discussion should include data analyses and an evaluation of all specific conductivity measurements (which began in 1994 at well 299-W23-14, 1992 at well 299-W23-15, 1992 at well 299-W22-45, 1992 at well 299-W22-21, 1991 at well 299-W22-39, and 1992 at well 299-W22-46). Section 4.2.2 provides a good, but incomplete discussion of specific conductivity observations and/or comparisons. Neither the discussion in Section 4.2.2 nor Appendix B provides an explanation or a derivation of the mean natural background value of 344 $\mu\text{mhos/cm}$ for groundwater upgradient of Hanford facilities. More importantly, the assessment does not provide justification for using the mean natural background rather than the upgradient average background. Most importantly, the assessment report does not appear to compare specific conductivity observations from upgradient monitoring well 299-W23-14 to downgradient monitoring wells. Furthermore, the Appendix B discussion completely omits discussion of utility line contributions/effects to specific conductivity observations. The report must include all data used to derive the statistical mean for the upgradient well(s) and include an explanation and/or equation identifying how the specific conductivity measurements were averaged to obtain the background. Note: a cursory review of specific conductivity measurements collected from upgradient well 299-W23-14 from September 1994 to May 1998 yielded an average specific conductivity of 241 $\mu\text{mhos/cm}$. This average falls within the stated "general background from a waste source" category range of 225-260 $\mu\text{mhos/cm}$. Also, a cursory review of specific conductivity measurements collected since 1994 indicates specific conductivity measurements from downgradient wells were consistently higher than from upgradient wells (299-W23-14 and 299-W23-13) until February 1996. Of interest, from February 1996 to May 1998, at RCRA downgradient wells 299-W23-15, 299-W22-46, and 299-W22-39, specific conductivity measurements were lower than those collected from RCRA upgradient well 299-W23-14.

The discussion on page 4.7 predicts lower observed values for specific conductivity measurements due to utility line leaks. This generalization appears to explain the observations for the SX tank farm, but lower specific conductivity values are not observed in S tank farm downgradient monitoring wells (as reflected by Figure 4.3 and HEIS data). Therefore, it may be appropriate to apply two separate specific conductivity analyses (comparisons between upgradient and downgradient wells), one for the SX tank farm wells (299-W23-14, 299-W23-15, 299-W22-46, and 299-W22-39) and one for the S tank farm wells (299-W23-13, 299-W23-1, 299-W23-7, and 299-W22-45).

111. Page 4.7, Section 4.2.2, 2nd full paragraph. The first sentence indicates the specific conductance in the vicinity of the S and SX tank farms is much lower than natural groundwater for the Hanford Site. Although it is agreed that the specific conductance is lower in the S-SX WMA area, this sub-section does not

discuss any comparisons between up and downgradient wells. As a generalization, upgradient well 299-W23-13 specific conductivity measurements are lower than downgradient well 299-W22-45. Similarly, upgradient well 299-W23-14 specific conductivity measurements are lower than downgradient wells 299-W23-15 (September 1994-August 1995), 299-W22-39 (September 1994-February 1996), and 299-W22-46 (September 1994-August 1995 and November 1996-May 1998) and 299-W22-45 (September 1994-May 1998). Include a statistical evaluation to determine if any of the downgradient increases are statistically significant.

112. Page 4.6, Figure 4.3. The 1997 conductivity contour inset should identify that the 299-W23-7 measurement of 160 $\mu\text{mhos/cm}$ represents the only measurement collected for 1997 and that it was collected by bailing. In addition, include an explanation how the contours were developed, (i.e., if all the well data were averaged).
113. Page 4.9, Section 4.2.3. The second paragraph indicates that well 299-W23-1 is an older well with a "poor or uncertain seal". Include an identification that the well was "remediated" in 1976 by perforating the 6-inch screen, installing a 4-inch casing, and grouting the annulus (*Assessment Groundwater Monitoring Plan for Single Shell Tank Waste Management Area S-SX*, WHC-SD-EN-AP-191, Rev.0). Also identify if there have been any measurements of gamma (in)activity from well 299-W23-1.
114. Page 4.9, Section 4.2.3. According to *Assessment Groundwater Monitoring Plan for Single Shell Tank Waste Management Area S-SX*, WHC-SD-EN-AP-191, Rev.0, the "listed use" of many of the S-SX WMA groundwater monitoring wells were "SST monthly water level measurements". For example, groundwater level measurements were collected on a monthly basis at well 299-W23-6 from June 1989 to March 1993, well 299-W23-7 from July 1974 to March 1993, well 299-W23-8 (which does not appear to be shown on Figure 1.2) from December 1989 to March 1993, well 299-W23-12 from July 1991 to March 1993, well 299-W22-39 from July 1991 to March 1993, well 299-W22-45, well 299-W22-46 from January 1992 to March 1993, well 299-W23-13 from July 1991 to March 1993, well 299-W23-14, from July 1991 to March 1993, well 299-W23-15 from January 1992 to March 1993, well 299-W23-2 from August 1955 to November 1992, and well 299-W23-3 from May 1956 to March 1993. Comparing the snow melt events to water level measurements (hydrographs) may yield correlations which may add to the discussion but are currently lacking.
115. Page 5.1, Section 5.0, 1st paragraph. There is no regulatory basis for the term "Phase I". Replace the term with "first determination assessment of 40 CFR 265.93(d) (by reference of WAC 173-303-400)".

116. Page 5.1, Section 5.0, 1st bullet. Radionuclides are considered to be waste constituents. Recommended wording for the first bullet is: "Distribution patterns for tank waste constituents (radionuclides, nitrate, chromate, etc.) in the vicinity of WMA S-SX indicate this WMA has contributed to groundwater contamination observed in downgradient monitoring wells."
117. Page 5.1, Section 5.0, 2nd bullet. Due to the spatial and temporal groundwater observations of contamination occurring at wells 299-W23-2 (1987-1989) and 299-W23-7 (1987 - 1989), at least four WMA source areas are needed to explain the technetium-99 observations at well 299-W23-7 and the technetium-99 and nitrate observations at well 299-W23-2. Considering the spatial and temporal vadose zone observations of radionuclide contamination, there could easily be more than four "source areas". Re-write the bullet to identify the additional groundwater observations occurring at wells 299-W23-2 and 299-W23-7 and include the appropriate identification of the vadose zone characterization information.
118. Page 5.1, Section 5.0, 3rd bullet. Please explain the drinking water standard of 45,000 µg/L used at this point. The groundwater quality criterion of WAC 173-200-040 for nitrate (as N) is 10 mg/L.
119. Page 5.1, Section 5.0, 3rd bullet. The bullet could be interpreted to imply there is a limitation to the contamination at and/or near wells 299-W22-46, 299-W23-6, and 299-W23-1. Tank waste constituents have re-occurred at wells 299-W23-1, 299-W22-39, 299-W22-46, 299-W23-7, etc. Include an identification of such re-occurrences in this bullet.
120. Page 5.1, Section 5.0, 3rd bullet. An observation of nitrate higher than the water quality criteria (10 mg/l) has occurred at well 299-W23-3 as recently as July 1995 (the most recent nitrate measurement at this well is 17 mg/l). Similarly, the most recent nitrate observations at well 299-W23-2 (15 mg/l measured March 1996), at well 299-W23-15 (11 mg/l measured February 1996), at well 299-W22-39 (17mg/l measured February 1996) all exceeded water quality criteria. Therefore, although it has been more than two years after nitrate was measured at most of these wells, it is unknown if nitrate is currently limited to well 299-W22-46 at this time. Either describe the most recent nitrate measurements at wells 299-23-3, 299-W23-2, 299-W23-15, and 299-W22-39 or re-write the sentence to identify that the limit of the nitrate water quality standard exceedances is unknown at this time.
121. Page 5.1, Section 5.0, 4th bullet. Either re-write the bullet to identify that since February 1996 (with only one exception), the groundwater samples collected for chromium analysis have been filtered and the decrease noted will have to be

confirmed by analysis of unfiltered samples. The other alternative is to delete chromium from this trend.

122. Page 5.1, Section 5.0, 4th bullet. Delete the second sentence of the bullet. The identification of future actions/determinations should be placed in Section 6.0.
123. Page 5.1, Section 5.0, 5th bullet. The term "short-term contaminant transients" is not clear. From the discussion and the data, perhaps "recurring contaminant transport" or "a mechanism for recurring contaminant transport" is more applicable wording for this phenomenon. If the term "short-term contaminant transients" is used, also provide a definition or explanation of the term.
124. Page 5.1, Section 5.0, 6th bullet. The HEIS data base indicates cesium-137 was detected at the following wells: 299-W22-46 (April 1992, July 1992, November 1992, and May 1997), 299-W22-39 (November 1991, January 1992, April 1992, and July 1992), and 299-W22-45 (April 1993). Identify and/or discuss these occurrences in relation to the conclusion.
125. Page 5.1, Section 5.0, 7th bullet. According to the HEIS data base, low but detectable cesium-137 was also found in another old well 299-W23-1. Include this information in the bullet. Also, include an identification that extensive vadose zone characterization information exists which confirms the presence of broadly distributed cesium-137 contamination. While it is important to determine if there is a communication pathway via the groundwater monitoring well from the S-SX WMA to the aquifer, an identification of the characterized vadose zone and the broad distribution of cesium-137 contamination should also be identified in this bullet or in another bullet.
126. Page 5.2. Again, nature and extent of contamination determination is needed for groundwater and soil zone.
127. Page 5.2, Section 5.0, 1st bullet. Insert the word "constituents" between "waste" and "reached" in the first sentence of the bullet. Also, identify in this bullet if the chromium samples were filtered prior to analysis.
128. Page 5.2, Section 5.0, 2nd bullet. Recommended re-wording is: "Further data are needed to monitor and/or determine the nature, extent, and source(s) of groundwater contamination (including recurrent contamination) attributed to WMA S-SX."
129. Section 6.0, General Comment. Section 6 does not satisfy the requirements of 40 CFR 265.93(d) in that the proposed actions do not describe how the rate and extent of migrating contamination will be delineated and monitored. In addition, even though the first determination has occurred over an extended period of time and the confirmation of multiple releases from the S-SX WMA has been

adequately substantiated, the section discusses a scenario by which the monitoring program may return to a "detection monitoring status". This implies either a lack of understanding of RCRA groundwater regulations or a conclusion that the S-SX WMA has not released hazardous waste constituents to the groundwater. The option to return to an indicator parameter monitoring program (as allowed by 40 CFR 265.93(d)(6)) occurs only when the owner/operator determines, based on the results of the first determination that groundwater has not been impacted by the unit. To explain further, if "no hazardous waste or hazardous waste constituents from the facility have entered the groundwater," then the owner/operator "may reinstate the indicator evaluation program." Therefore, Section 6 should be re-written to clearly identify what actions will be taken to delineate and monitor the rate and extent of migrating contamination from the S-SX WMA. For a minimum frequency of further determinations (of the assessment monitoring program), refer to 40 CFR 265.93(d)(7)(i).

130. Page 6.1. This section is missing any discussion of nature and extent proposed plans for vadose zone.
131. Page 6.1. Criteria for returning WMA unit to detection monitoring are premature at this point. Emphasis should be put on defining nature extent of contamination and possible corrective action.
132. Page 6.1, Section 6.0 title. Recommended re-wording is: "Proposed Further Determinations".
133. Page 6.1, Section 6.0, 1st paragraph. Recommended re-wording for the first sentence is: "The objectives of the proposed further determinations (required by 40 CFR 265.93(d)(7)(i) [by reference of WAC 173-303-400]) are: 1) to further delineate the nature and extent of migrating contamination (vadose and groundwater) associated with the S-SX WMA to support possible corrective action actions and/or options; 2) to understand the geochemical reactions tank waste constituents undergo in the vadose zone and groundwater; 3) to determine the appropriate tank waste constituents, reaction products and/or indicator parameters (including frequencies) to monitor; and 4) to assess the fitness-for-use of older non-RCRA compliant wells within the WMA."
134. Page 6.1, Section 6.0. 2nd paragraph. Change "Phase II" to "further determinations of 40 CFR 265.93(d)(7)(i) (by reference of WAC 173-303-400)".
135. Page 6.1, Section 6.0, 2nd paragraph bullets. The bullets must clearly identify which groundwater monitoring wells will be sampled, the frequency (quarterly) of sampling, and the constituents and parameters to be monitored. Note: due to the past filtration of samples, the bullets must identify that groundwater samples will not be filtered.

136. Page 6.1, Section 6.0, 3rd paragraph. Delete the first sentence that describes the three "if" scenarios by which indicator monitoring may be resumed. This is not an option as releases from the S-SX WMA to the groundwater have been confirmed.
137. Page 6.1, Section 6.0, 3rd paragraph. Well 299-W22-44 should be removed from the quarterly monitoring program, as the well does not adequately represent a downgradient well located at the S-SX WMA's "point of compliance".
138. Page 6.1, Section 6.0, 3rd paragraph. The proposed upgrades should be based upon well-specific data and should clearly identify what work/upgrades will be performed on which wells.
139. Page 6.1, Section 6.0, 4th paragraph bullets. The bullets need to describe and/or indicate specific actions. For example, the first bullet should identify which wells will be sampled for which constituents. As another example, the second bullet should either identify the conditions for the "if necessary" qualifier or remove the qualifier and identify that monthly measurements will be made. Note: due to the filtration of chromium, no determination can be made on any chromium concentration trends.
140. Page 6.1, Section 6.0, 4th paragraph, 3rd bullet. Include the basis for using well 299-W23-9 as an upgradient well for constituent concentration comparison purposes. Considering the direction of groundwater flow and the location of well 299-W23-9, this well does not appear to represent a well that will yield a representation of groundwater quality passing the upgradient unit boundary of the S-SX WMA.
141. Page 6.1, Section 6.0, 4th paragraph, 4th bullet. The large volume pumping is noted to be approximately 1040 gallons. Prior to approving this action, a plan describing how the well purging will be performed must be submitted for review. The plan should identify the rate of purging, a description of how purging will be performed, the sampling intervals, a description of well history, a description of well development, an identification of sampling parameters, etc.
142. Page 6.1, Section 6.0, 4th paragraph, 5th bullet. The selective moisture content measurement is noted. As moisture and/or water sources may account for periodic occurrences of groundwater contamination, a plan describing how the moisture logging will be performed across the S and SX farms must be submitted for review prior to approval.
143. Section 6.0. Include an identification of actions to be taken to further delineate the rate and extent of migrating contamination in the vadose zone.

144. Section 6.0. Include an identification of actions to be taken to identify and eliminate potential water sources (i.e., leaking water lines, water logging, rupture events, etc.) within and around the tank farms.
145. Page 6.2. Regulators will approve this subsequent workplan for phase II. A discussion of how this phase II ties into an RFI process is needed. Also discuss how all of this will be tied into the site-wide permit process.
146. Page 6.2. Owner operators of TSD facilities impacting groundwater are obligated to proceed to corrective action phase. This can be and should be self-imposed by the owner/operator.



STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

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July 31, 1998

Mr. Marvin J. Furman
U.S. Department of Energy
P.O. Box 550, MSIN: HO-12
Richland, WA 99352

Dear Mr. Furman:

Re: Comments on "Results of Phase I Groundwater Quality Assessment for Single-Shell Tank Waste Management Areas B-BX-BY at the Hanford Site" February 1998 (PNNL-11826)

The Washington State Department of Ecology (Ecology) has initiated its review of the above document. The number of comments generated thus far has prompted Ecology to provide you with the enclosed list of completed comments. Ecology believes this transmittal will give the U.S. Department of Energy (USDOE) and its contractors sufficient direction to begin revising the document. As can be observed from the enclosed comments, substantial editing of this document is necessary. Additional comments may be forthcoming as Ecology completes its review.

Ecology will also provide comments on the remaining two Single-Shell Tank Groundwater Quality Assessments that USDOE has transmitted to Ecology. However, Ecology expects that many of the issues identified in the enclosed comments will also be applicable to these other documents.

If you have any questions, please contact me at (509) 736-3018, or Stan Leja at (509) 736-3046.

Sincerely,

Dr. Alex Stone, TWRS Project Manager
Nuclear Waste Program

AS:sb
Enclosure

cc: Maureen Hunemuller, USDOE
Bob Lober, USDOE
Mike Thompson, USDOE
Doug Sherwood, EPA
Janice Williams, FDH
Dave Myers, LMHC
Jim Bertch, MACTEC
Administrative Record: SST TSD S-2-4 and Vadose Zone Characterization

Stuart Harris, CTUIR
Stan Sobczyk, NPT
Wade Riggsbee, YIN
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"Results of Phase I Groundwater Quality Assessment for Single-Shell Tank Waste Management Areas B-BX-BY at the Hanford Site" February 1998 (PNNL-11826)

1. Page iii, Summary, 1st paragraph. The term "Phase I" has no regulatory basis. Delete the term and insert the applicable regulatory citation. Recommended wording is: "Pacific Northwest National Laboratory conducted a "first determination" groundwater quality assessment for the U.S. Department of Energy, Richland Operations Office, in accordance with 40 CFR 265.93(d)(4) by reference of WAC 173-303-400(3)."
2. Page iii, Summary, 1st paragraph. The last sentence of the paragraph should clearly reflect the regulatory status of the groundwater monitoring program. In addition, the applicable regulatory citations should be used. Recommended wording is: "This report documents the first determination evaluation of 40 CFR 265.93(d)(4) and describes the assessment monitoring program of 40 CFR 265.93(7)(i)."
3. Page iii, Summary, 2nd paragraph. As Washington Administrative Code (WAC) 173-303-040 defines "ancillary equipment", insert the words "equipment and" between the words "ancillary" and "waste systems" in the first sentence.
4. Page iii, Summary, 2nd paragraph. The second sentence should read "The unit is regulated under RCRA interim-status regulations (40 CFR, Subparts J and F, by reference of WAC 173-303-400(3)) and was placed in assessment groundwater monitoring (40 CFR 265.93(d)(4) after elevated conductivity in B-BX-BY WMA downgradient monitoring wells was confirmed pursuant to 40 CFR 265.93(d)(1)."
5. Page iii, Summary, 2nd paragraph. The third sentence indicates the rise in conductivity was initially observed in well 299-E33-32 in February 1996. Figure 1.3 of the assessment report indicates the rise in conductivity was initially observed in January 1995. If Figure 1.3 is interpreted correctly, revise the sentence to read: "A rise in conductivity of statistically significant difference was initially observed in this well in January 1995."
6. Page iii, Summary, 3rd paragraph. The term "Phase I" has no regulatory basis. Delete the term in the first sentence and insert the applicable regulatory citation. Recommended wording is: "During the indicator parameter monitoring program of 40 CFR 265.92, a rising trend of water quality parameters (sodium, sulfate, nitrate, and chloride) was observed in downgradient well 299-E33-41 beginning in January 1995. In the February 1997 sample for well 299-E33-41, elevated conductivity was also observed."

7. Page iii, Summary, 3rd paragraph. In the second sentence the words "increases in" is used to describe the groundwater monitoring data of downgradient well 299-E33-41. It is noted the increases can be described, for the most part, to have been consistent. Therefore, the word "increasing" would better describe the data.
8. Page iii, Summary, 3rd paragraph. Although technetium-99 is not regulated by RCRA as a listed waste, the contaminant is a constituent of the mixed waste. In addition, there are clearly toxicity attributes of the contaminant as well as associated drinking water standards. Delete the "non-RCRA co-contaminant" wording. Recommended wording is: "The concentration of technetium-99, a constituent of the mixed waste, also rose..."
9. Page iii, Summary, 3rd paragraph. Although the third sentence correctly describes the February 1997 sample observation for technetium-99, Figure 1.4 indicates technetium-99 also rose above the drinking water standard of 900 pCi/L for the February 1995 and August 1995 samples. Therefore, insert the identification of the February 1995 and August 1995 observances. Recommended wording for the third sentence of the paragraph is: "The concentration of technetium-99, a constituent of the mixed waste, also rose above the drinking water standard of 900 pCi/L for the February 1995 and August 1995 samples."
10. Page iii, Summary, 3rd paragraph. Identify that uranium concentrations in well 299-E33-41 have exceeded the 20 µg/L drinking water standard during the November 20, 1997, December 4, 1997, January 6, 1998, and February 4, 1998 sampling events.
11. Page iii, Summary, 4th paragraph. In the first sentence, the word "remobilized" is used. As a general comment for the entire document, the word is repeatedly used throughout. Due to the usage, Ecology requires a technical basis for the use of the word to be provided in the document as well as a definition. The word denotes a stoppage of the single-shell tank (SST) waste and/or waste constituents. If a satisfactory technical basis and definition cannot be provided, delete the use of the word throughout the document. A recommended word to be used in place of "remobilized" is "migrating".
12. Page iii, Summary, 4th paragraph. In the first sentence, insert the words "and/or waste constituents" between "tank waste" and "either".
13. Page iii, Summary, 5th paragraph. In the first sentence it is indicated that contamination observed at well 299-E33-41 "has only recently entered the groundwater as evidenced by the sudden sharp rise in anion and technetium-99 concentrations." According to Figures 1.3 and 1.4 (and HEIS data), the rise in anion and technetium-99 concentrations rose gradually beginning in January 1995 and suddenly in or around January 1997. Re-write the sentence to accurately

describe the observations. Recommended wording is: "The contamination observed at well 299-E33-41 has gradually (August 1992 through June 1993 and February 1995 through November 1996) and suddenly (February 1997, August 1997, and November 1997) risen as evidenced by the measured anion and technetium-99 concentrations."

14. Page iii, Summary, 5th paragraph. The second sentence appears to be stating a risk-based opinion. As this is neither technically supported by nor the intent of the document, delete the sentence.
15. Page iii, Summary, 5th paragraph. Although the last sentence of this document will be deleted, the words "isolated event" to describe the contamination is noted with interest. If the words "isolated event" are used to describe the B-BX-BY WMA impacted groundwater in this report, a basis for usage of this word will be required. Considering the unit releases and indications of leaking tanks, as well as the data trends observed, the words "isolated event" do not appear to correctly describe the B-BX-BY WMA groundwater contamination.
16. Page iii, Summary, 6th paragraph. Re-write the sentence to state a fact or to describe an observation. Recommended wording is: "Rising trends of technetium-99 and nitrate in other groundwater monitoring wells downgradient to B-BX-BY WMA have been observed."
17. Page iii, Summary, 6th paragraph. The intent of the first determination requirement of 40 CFR 265.93(d) is to either confirm if the B-BX-BY WMA has impacted groundwater and continue determinations under 40 CFR 265.93(d)(7)(i) or to demonstrate the B-BX-BY WMA has not impacted groundwater and return to the indicator parameter monitoring program of 40 CFR 265.92.

Ecology has reviewed the assessment report as well as other pertinent information/data (HEIS data) and has concluded that the first determination requirements of 40 CFR 265.93(d)(4-5) have been occurring from early 1995 to early 1998 and have been fulfilled. In addition, Ecology has concluded that the first determination has conclusively demonstrated in a technically feasible fashion that the B-BX-BY WMA has impacted groundwater.

Therefore, the groundwater assessment monitoring program requirements of 40 CFR 265.93(d)(7)(i) are applicable and the determinations of 40 CFR 265.93(d)(4) must continue to be made. The summary is required to reflect completion of the first determination of 40 CFR 265.93(d)(4) and that further determinations will be made as required by 40 CFR 265.93(d)(7)(i).

Delete the last two sentences of the sixth paragraph. Insert sentences or a new paragraph that reflects the regulatory determination of this notice. Recommended wording is: "The first determination requirements of 40 CFR 265.93(d)(4) occurred from

February 1995 to February 1998. It has been determined that the B-BX-BY WMA has impacted groundwater. Therefore, the indicator parameter monitoring program of 40 CFR 265.92 will not be resumed and the assessment monitoring program requirements of 40 CFR 265.93(d)(7)(i) will continue.”

18. Page iii, Summary, 7th paragraph. Phase II of the assessment is identified but has no regulatory basis. Delete the term. Include a citation of 40 CFR 165.93(7)(i) in relation to future “determinations”. Recommended wording is: “Further determinations of source(s), nature, and extent of groundwater contamination attributable to B-BX-BY WMA will be conducted pursuant to 40 CFR 265.93(7)(i) by reference of WAC 173-303-400(3).”
19. Page 1.1, Section 1.0, 1st paragraph. For clarity, change the word “facilities” to “tanks and ancillary equipment and waste systems”.
20. Page 1.1, Section 1.0, 1st paragraph. Tank requirements are also applicable. In addition, the applicability through the Washington Administrative Code should also be identified/cited. Therefore, in the last sentence of the paragraph, the following text is recommended: “As such, these tanks are subject to interim-status regulations, Title 40, Code of Federal Regulations Part 265, Subparts F and J (40 CFR 265.92 and 265.196 [by reference of Washington Administrative Code {WAC} 173-303-400(3)]).
21. Page 1.1, Section 1.0, 2nd paragraph. In the first sentence and throughout the document, the term “Phase I” in relation to the “first determination” of 40 CFR 265.93(d) has no regulatory basis. For clarity, delete the term here and throughout the document.
22. Page 1.1, Section 1.0, 2nd paragraph. From the data included in the report, the first determination is concluded to have occurred from February 1995 to February 1998. Change “June 1996” to “February 1995” in the second sentence of the paragraph. Similarly, due to Ecology’s review turn-around time, the additional pertinent information contained in “Hanford Tank Farms Vadose Zone Tank Summary Data Report for Tank BX-102” (September 1997 GJ-HAN-89), and additional monitoring data obtained from August 1997 to February 1998, change the end date of the assessment to February 1998.
23. Page 1.1, Section 1.0, 2nd paragraph. It is recommended that this paragraph also identify assessment requirements of 40 CFR 265.196(3). The following text is recommended to be inserted between the 1st and 2nd sentences of the paragraph: This document also contains the initial investigative results of release(s) from the RCRA SST system as required by 40 CFR 265.196(3) (by reference of WAC 173-303-400(3)).”

24. Page 1.1, Section 1.0, 2nd paragraph. The following phrase is recommended to be inserted in the last sentence of the paragraph between the words "support" and "the": "and are considered part of".
25. Page 1.1, Section 1.1, 1st paragraph. Insert the following sentence between the 2nd and 3rd sentences: "Regulatorily, these wastes are defined in WAC 173-303-040 as 'mixed wastes'".
26. Page 1.1, Section 1.1, 2nd paragraph. The last sentence implies the interim status groundwater monitoring was occurring as "detection" monitoring. It should be noted that the interim status monitoring programs are typically referred to as "indicator parameter" or "assessment" monitoring. A monitoring program used for final status facilities prior to releases from the unit to the groundwater is called "detection" monitoring. Similarly, a monitoring program used for final status facilities after releases from the unit have occurred to the groundwater is called "compliance" monitoring. Therefore, it is recommended the words "detection-level" in the last sentence be changed to "indicator parameter".
27. Page 1.1, Section 1.1, 4th paragraph. Although technetium-99 is not regulated by RCRA as a listed waste, the contaminant is a constituent of the mixed waste. In addition, there are clearly toxicity attributes of the contaminant as well as associated drinking water standards. Lastly, it should be noted that 40 CFR 265.93(d)(4) clearly and repeatedly specifies that "hazardous waste constituents" (extent, rate, and concentration) shall be evaluated during assessment monitoring. Delete the "non-RCRA co-contaminant wording". Recommended wording is: "...increases, technetium-99, a constituent of the mixed waste, was observed..."
28. Page 1.1, Section 1.1, 4th paragraph. The second sentence implies that the first statistical difference of an indicator parameter (specific conductivity) occurred in February 1996 and was confirmed in June 1996 (4 months later) by "verification" sampling. Although not stated, it is assumed that the "verification" sampling was performed to satisfy requirements of 40 CFR 265.93(c)(2). The same sentence continues on to identify a statistical critical mean of 365.7 $\mu\text{mhos/cm}$. The following issues are related to this sentence:

Figure 1.3 indicates specific conductivity was measured in well 299-E33-32 above the statistical critical mean value of 365.7 $\mu\text{mhos/cm}$ in early 1995. HEIS data indicates the statistical critical mean value of 365.7 $\mu\text{mhos/cm}$ was exceeded during the September 1993, February 1995, and February 1996 sampling events. It is also noted that the statistical critical mean value of 365.7 $\mu\text{mhos/cm}$ was almost exceeded during the August 1995 sampling event. Given this scenario, the statistical increase verification of this indicator parameter as required by 40 CFR 265.93(c)(2) could have been performed as early as early 1993. Also given this scenario (as well as the collection of waste constituent concentration data from the

groundwater monitoring system), the first determination of 40 CFR 265.93(d)(4) can be considered to have been initiated as early as early 1995.

The assessment report does not contain an explanation or a derivation of the critical mean value of 365.7 $\mu\text{mhos/cm}$. The report must include all data used to derive the statistical mean as well as an explanation and/or equation which identifies how the specific conductivity measurements were averaged to obtain the critical mean value of 365.7 $\mu\text{mhos/cm}$. Note: If specific conductivity measurements from an upgradient well other than 299-E33-33 were used, justification must be provided. In addition, if data other than from 299-E33-33 were used, a statistical critical mean derivation using only 299-E33-33 data must also be submitted.

In conclusion, for purposes of satisfying the groundwater monitoring requirements of 40 CFR 265 (by reference of WAC 173-303-400(3)), Ecology has determined that the initiation of first determination monitoring of 40 CFR 265.93(d)(4) occurred in early 1995. As such, the statement of problem of Section 1.1 should be re-written to describe the earlier critical mean exceedences of specific conductivity.

29. Page 1.1, Section 1.1, 2nd paragraph. See the comment immediately preceding this one. Re-write the second half of the paragraph accordingly. In addition, delete from discussion the consideration of a false positive or identify it in relation to having already performed the first determination for over a year and justify the previous 5-6 sampling observations. It should be noted that a return to the indicator parameter monitoring program (40 CFR 265.93(d)(6)) was only an option after determining (40 CFR 265.93(d)(4-6)) that no hazardous waste or hazardous waste constituents from the B-BX-BY WMA had entered the groundwater.
30. Page 1.1, Section 1.1, 4th paragraph. Insert an identification that "Along with conductivity increases observed in early 1995, technetium-99, a constituent of the mixed waste, was observed above the 900 pCi/L Drinking Water Standard (DWS) for well 299-E33-41(Figure 1.4). Technetium-99 values rose from 232 pCi/L to 948 pCi/L (February 1995) and 1630 pCi/L (August 1995). For the next three quarterly sampling events, the value dropped to 889.6, 600.08, and 506 pCi/L (February 1996, August 1996, and November 1996 respectively) only to rise again in February 1997 to 5740 pCi/L. For the next quarterly sampling, the value again dropped to 523 pCi/L (May 1997) only to rise again in August 1997 to 12,000 pCi/L."
31. Page 1.5, Section 1.1, 2nd paragraph. The assessment monitoring program of 40 CFR 265.93 requires the evaluation of "hazardous waste or hazardous waste constituents". Specific conductivity represents an indicator parameter which was

monitored in the indicator parameter monitoring program of 40 CFR 265.92(b)(3). Technetium-99 represents a dangerous waste constituent that will be monitored during the assessment monitoring program. Therefore, the following text is recommended to replace the existing paragraph: "Although it was elevated conductivity in well 299-E33-32 that initially triggered the WMA into an assessment monitoring program, it is the presence, as well as elevated concentrations, of dangerous waste constituents (i.e., technetium-99, nitrate, sodium, chloride, sulfate, etc.) that require the WMA to remain in an assessment monitoring program."

32. Section 1.1. From the HEIS data, the following gross beta concentrations measured in well 299-E33-41 are noted: 667 (February '97), 1670 (May '97), 3790 (August '97), 780 (August '97), 1100 (October '97), and 2860 (November '97). The drinking water standard for gross beta is noted to be 50 pCi/L. The concentrations measured from July 25, 1991 to present have greatly exceeded the DWS. Include a trend plot of gross beta measurements for the B-BX-BY WMA RCRA groundwater monitoring network. Also include a discussion of the B-BX-BY WMA RCRA monitoring well network observations and trends. Clearly, the upgradient well 299-E33-33 gross beta measurements are well below drinking water standards while wells 299-E33-31, 299-E33-32, 299-E33-41, and 299-E33-42 are well above the DWS of 50 pCi/L. Similarly, it is clear that an increase of gross beta concentrations trend is observed in the downgradient wells. Lastly, this data would support the initiation of an assessment monitoring program as early as 1991.
33. Page 1.5, Section 1.2, 1st paragraph. The term "Phase I investigation" has no regulatory basis. Replace the term with "first determination".
34. Page 1.5, Section 1.2, 1st paragraph. Insert "and/or hazardous waste constituents" between the words "wastes" and "from" in the first sentence.
35. Page 1.5, Section 1.2, 1st paragraph. Recommended text for the 2nd sentence of the paragraph is as follows: "If, however, it is determined that dangerous waste and/or dangerous waste constituents from the WMA have entered the groundwater, then an assessment monitoring program must be implemented to define the rate of migration, the areal extent of the resultant groundwater plume, and the concentration of the hazardous constituents."
36. Page 1.5, Section 1.2, 2nd paragraph. Change the question to: "Have dangerous wastes and/or dangerous waste constituents from the WMA reached groundwater?"
37. Page 1.6, Section 1.3, 1st paragraph. The term "Phase I investigation" has no regulatory basis. Replace the term in the first sentence with "the first determination required by 40 CFR 265.93(d)(4-7)."

38. Page 1.6, Section 1.3, 1st paragraph. Include the term "and B-BX-BY unit-specific" between "site-" and "constituents" in the second sentence.
39. Page 1.6, Section 1.3, 1st paragraph. In the third sentence, delete "is a non-RCRA co-contaminant" and replace it with "represents a mixed waste constituent."
40. Page 1.6, Section 1.3, 1st paragraph. Delete the third sentence which begins "The elevated conductivity..." Insert the following: "The first determination required by 40 CFR 265.93(d)(4) was initiated in early 1995 after elevated conductivity was observed in well 299-E33-32 which triggered the B-BX-BY WMA assessment monitoring program."
41. Page 1.6, Section 1.3, 1st paragraph. Delete "continued monitoring" at the end of the fifth sentence and replace it with "further determinations under 40 CFR 265.93(d)(7)(i)."
42. Page 1.6, Section 1.4, 1st paragraph. Delete "Phase II investigation" and replace it with "further determinations of 40 CFR 265.93(d)(7)(i)."
43. Page 1.6, Section 1.4, 1st paragraph. As groundwater was observed to be contaminated in 1995 by technetium-99, delete the word "recent" in the fourth sentence.
44. Page 1.6, Section 2.0, 1st paragraph. The paragraph should be re-written to describe the first determination in the past tense. The following re-write is provided: "This assessment of groundwater quality has involved the development of a conceptual model integrating the characteristics of the hydrogeological system and the waste management unit setting. This model includes the general waste types, the geology, the hydrogeology, and the geochemistry of the vadose zone and the unconfined aquifer. Hence, the movement of B-BX-BY WMA contaminants into and through the vadose zone and the unconfined aquifer could be better understood and possibly predicted. Specifically, the purpose of the conceptual model is to explore the complexity and spatial relationships of four important parameters: the B-BX-BY WMA contamination source, the driving force, the migration pathway, and rate of contaminant migration/transport."
45. Section 2.0. Add a sub-section that describes the tank wastes of the B-BX-BY WMA. In particular, include a thorough description of wastes containing technetium-99, uranium, arsenic, chromium, nitrate, sodium, chloride, sulfate, etc.. It is noted that tank characterization reports are available for many of the tanks that describe the chemical make-up of the wastes. Due to the tank farm occurrences, tank leakers/re-leakers status, and proximity to well 299-E33-41, a tank-waste-specific discussion of the waste chemistry of tank 241-BX-102 is requested to be included.

46. Page 2.1, Section 2.1.1, 1st paragraph. For consistency with the rest of the document, change "hazardous and radioactive" to "mixed waste(s) and/or mixed waste constituent"
47. Page 2.3, Section 2.1.1, 2nd paragraph. A total leak volume for the three tank farms is provided as well as a leak volume for tank 241-BX-102. An identification of leak volumes for specific tanks must be added to this assessment report. In addition, it is also necessary to describe the source of the leak volume estimates and indicate the uncertainty associated with these numbers. Similarly, it is requested that respective information regarding spill volumes, dates, and locations for the three tank farms be added to this assessment report.
48. Page 2.3, Section 2.1.1, 5th paragraph. This paragraph provides a status of tank contents and references Hanlon 1996. It is requested that Hanlon 1998 be referenced and the waste volumes of Table E-3 (February 28, 1998) for the B, BX, and BY tank farms be included in the report. Data/information from Table E-6 to indicate which tanks are considered sound and which are considered assumed leakers is also requested to be included in this assessment report.
49. Page 2.3, Section 2.1.1, 7th paragraph. The first sentence needs to be re-written in perspective of capacity or some other relation. Although the B-BX-BY tank farms may now only contain approximately 860,000 gallons of drainable liquid, this amount still represents a large amount of liquid in relation to a release. Either delete the first sentence, re-write it using actual data, or re-write it in context with past release comparisons.
50. Page 2.3, Section 2.1.1, 7th paragraph. In the last sentence, the word "remobilized" is used. As a general comment for the entire document, the word is repeatedly used throughout. Due to the usage, Ecology requires a technical basis for the use of the word to be provided in the document as well as a definition. The word denotes a stoppage of the single-shell tank (SST) waste and/or waste constituents. If a satisfactory technical basis and definition cannot be provided, delete the use of the word throughout the document. The following is a recommended re-write: "These vadose zone plumes are potential sources of tank waste contamination that could either migrate or be migrating to negatively impact groundwater quality".
51. Page 2.4, Section 1.1.1, 2nd paragraph. "Non-tank leaks" are described in this section of the report. It should be noted that although the released waste described is from spillage rather than tank leakage, regulatorily, the released waste is associated with the management of the B-BX-BY tank farms and as such, constitutes a release from the B-BX-BY WMA. To better associate the releases with the tanks, change the title of this discussion from "Non-Tank Leaks" to "Tank Waste Spills".

52. Page 2.4, Section 1.1.1, 2nd paragraph. Delete the last sentence of the paragraph. The section is discussing tank waste spills rather than the potential driving forces of the spilled waste contamination.
53. Page 2.4, Section 1.1.1, 3rd paragraph. In the last sentence of the paragraph, change "could be" to "are".
54. Page 2.4, Section 1.1.1, 3rd paragraph. The term "residual plumes" is used. The meaning of this term is neither technically justified nor defined by the document. A recommended re-write of the last sentence of the paragraph is: "Given a sufficient driving force, any of these contaminated soils and/or soil zones could be or become a source for groundwater contamination."
55. Page 2.5, Section 2.2, paragraph from preceding page. As Ecology has determined the first determination is complete, change the wording to past tense. Recommended wording is: "Consequently, constituents' chemical signatures have been evaluated with other considerations, such as trend characteristics (see trend analyses discussion of Section 3)."
56. Page 2.5, Section 2.3, 1st paragraph. The first sentence states "pick up and remobilize a residual tank waste vadose zone plume." The remobilization of contaminants is neither technically justified nor defined by the document. Either provide the technical basis for use of the word "remobilize" or re-write the sentence. Recommended wording is: "...must be available to either increase mobilization or transport released tank waste contaminants."
57. Page 2.5, Section 2.3, 3rd paragraph. Re-write the words "escaped waste" in the first sentence. Recommended words are: "released tank waste contaminants."
58. Page 2.6, Section 2.4, 3rd paragraph. Although poorly sealed dry wells within the farm boundaries are described as a vertical pathway for rapid migration of contaminants, poorly sealed boreholes and/or wells in the vicinity of the B-BX-BY WMA are not identified or discussed. Although poorly sealed boreholes and/or wells located beyond the tank farm filled areas or boundaries are not likely to provide for as rapid migration, the vertical migration would still be relatively rapid. Therefore, include an identification of poorly sealed boreholes and/or wells in the vicinity of the B-BX-BY WMA as potential rapid vertical migration pathways.
59. Page 2.6, Section 2.4, 3rd paragraph. Although Figure 1.2 of this report identifies wells in the vicinity of B-BX-BY WMA, it does not identify or denote the quality of the seals of the "RCRA", "non-RCRA" and "Vadose Zone" wells. In addition, the quality of the seals does not appear to be discussed in Chapters 2 or 3. As poorly sealed wells may be considered a plausible rapid vertical migration

pathway, the assessment report must include a discussion of this issue. The discussion should identify all borings and/or wells in the vicinity of the B-BX-BY WMA, a description of the seals, and an evaluation or assessment of the quality of the seals.

60. Page 3.1, Section 3.0, 1st paragraph. As the first determination of 40 CFR 265.93(d) is complete, the text must be re-written in past tense to describe the findings. Recommended re-write of the first sentence of the first paragraph is: "In this chapter, various observations are made that are pertinent to determining the WMA B-BX-BY source(s) of contamination found in the groundwater." Note: the word "recently" is deleted in relation to when groundwater contamination was found as groundwater monitoring data support the "finding" occurred as early as '93 and definitively in early '95.
61. Page 3.1, Section 3.0, 2nd paragraph. As the first determination of 40 CFR 265.93(d) is complete, the text must be re-written in past tense to describe the findings. In addition, it is noted that the groundwater flow discussion of Section 3.2 supports the first determination conclusion that releases from the B-BX-BY WMA have negatively impacted groundwater quality. The discussion of Section 3.2 also emphasizes the importance of accurately measuring the groundwater flow direction (via surface water elevation measurements and evaluations) to support an accurate interpretation of the changing groundwater flow direction. A recommended re-write of the first and second sentences of the paragraph is as follows: "The section on stratigraphy is followed by a brief discussion of the groundwater flow. An accurate understanding of the recently changing flow direction in the vicinity of this WMA is needed in order to be able to properly interpret developing temporal and spatial patterns of groundwater contamination.
62. Page 3.1, Section 3.0, 3rd paragraph. Delete the word "recently".
63. Page 3.1, Section 3.0, 4th paragraph. Change the word "source" in the first sentence to "this first".
64. Page 3.1, Section 3.0, 4th paragraph. Re-write the second sentence in past tense in relation to the first determination conclusions reached. A recommended re-write is: "Along with the results are observations of constituent occurrences, constituent patterns and co-varying trends, which support the first determination conclusion associated with the contamination found at well 299-E33-41."
65. Page 3.1, Section 3.0, 5th paragraph. Re-write the sentence to use another word other than "remobilize". It is noted that until such time that contaminant transport (pathway and rate) through the unsaturated and/or saturated soil column is understood or confirmed, the word "remobilize" may inaccurately describe the observations. Recommended wording is: "These sources may have acted or contributed as a driving force to assist the waste and/or waste constituents in the

vertical pathway(s) to migrate through the vadose zone to well 299-E33-41 just prior to and during the drilling of this well.”

66. Page 3.1, Section 3.0, 5th paragraph. Due to the lack of understanding associated with B-BX-BY WMA contamination in the vadose (i.e., the dynamics of contaminant transport), it is noted the last sentence of the fifth paragraph may incorrectly refer to “the vadose zone plume”. Recommended re-wording is: “....in the vicinity of B-BX-BY WMA vadose zone contamination and well 299-E33-41”.
67. Page 3.4, Section 3.2. Figure 3.3 provides hydrographs of five of the wells comprising the RCRA network. It is noted from Figure 3.3 that most of the groundwater surface elevations of the network were taken or collected at the same time. As the groundwater surface level is recently and gradually changing, groundwater “potentiometric” surface maps are required to be inserted as figures in this section. At a minimum, groundwater surface maps are requested for the following dates: July '91, November '91, April '92, August '92, March, '93 September '93, January/February '95, August '95, February '96, August '96, May '97, and November '97. In addition, it is noted that Figure 3.3 provides hydrographs for only 5 wells. Figure 1.2 identifies at least nine “RCRA monitoring wells.” It is requested that the groundwater table elevation maps include the maximum number of data points. Although the majority of groundwater wells shown in Figure 1.2 are “non-RCRA monitoring wells”, the groundwater surface elevation measurements collected should be considered for use in this report. Lastly, for well data not used for the potentiometric surface maps, include an identification and explanation of wells and/or data omitted from the maps.
68. Page 3.4, Section 3.2. It is requested that water table elevation maps similar to Figure 3.2 be included in this report for '91, '92, '93, '94, '95, and '96.
69. Page 3.4, Section 3.2. The second sentence of the fourth paragraph indicates the wells were surveyed “to eliminate any error associated with references to datum”. Include the date of survey and the before and after riser surface elevations or whatever depth to water reference elevations were used. This information may be included as an appendix of the assessment report.
70. Page 3.4, Section 3.2. It is required that well design schematics be provided for the RCRA network (including wells E33-31, E33-32, E33-33, E33-41, and E33-42). This information may be provided in an appendix to the document.
71. Page 3.4, Section 3.2. Provide an explanation or identification (whichever is applicable) of why E33-43 is not being used as part of the network. Similarly, identify if E33-36 is being used as part of the network.

72. Page 3.4, Section 3.2, 5th paragraph. Due to the observed decline of the groundwater surface elevation/table, include an identification or description of well development histories associated with each network monitoring well. This information may be provided in an appendix to the document.
73. Page 3.4, Section 3.2, 5th paragraph. Delete the last sentence of the paragraph. A sentence similar to this one will be stated in Chapter 6.
74. Page 3.4, Section 3.2, 6th paragraph. Change the sentence to past tense and indicate that analyses have been performed. It is Ecology's conclusion that the first determination has been completed. In addition, it is Ecology's conclusion of the alternative flow directions and the applicable monitoring data provided in this assessment (and to be visually displayed by the B-BX-BY WMA local groundwater surface contour maps) that the source(s) of the groundwater contamination observed in wells 299-E33-31, 299-E33-32, 299-E33-41, and 299-E33-42 is(are) due to tank waste releases from the B-BX-BY WMA. Recommended re-wording for the sixth paragraph is: "Because there is uncertainty in both the recent past and future groundwater flow direction beneath the tank farms, the first determination analyses of the groundwater contamination data have considered possible alternative flow directions."
75. Page 3.6, Section 3.3, 1st full paragraph. Section 3.3 discusses regional contamination. The last sentence of the paragraph identifies a potential expectation regarding chromium. As this section is describing regional plumes, this sentence appears misplaced. Either delete the sentence or include discussions of contaminant transport rates (including geochemical reaction information [i.e., hexavalent versus trivalent chromium states]) of all contaminants identified in the section.
76. Page 3.6, Section 3.3, last sentence of the section. Include the basis of the statement. Identify that a concentration of technetium-99 has been measured at well 299-E33-41 at 12,000 pCi/L that represents an order of magnitude greater than the regional technetium-99 plume. Clearly identify that this observation cannot be attributed to the regional plume.
77. Page 3.6, Figure 3.3. The graph is hard to read due to the inclusion of numerous data points/measurements. It is indicated that "spurious data were removed". It is also indicated that the wells were recently surveyed to eliminate survey error in the elevations. Due to the importance of this information, the data should be included in an appendix to the report. Spurious data should also be included and flagged accordingly. In addition, the re-survey of the wells should be discussed. In particular, if the groundwater elevation data was "adjusted" after the re-survey, this information must be explained.

78. Page 3.6, Section 3.4, 1st paragraph. Insert the words "in and" between "region" and "around" in the first sentence.
79. Page 3.8, Section 3.4, 2nd paragraph. The first sentence indicates there are seven wells in the B-BX-BY WMA RCRA assessment monitoring network. As previously indicated in an above comment, the monitoring well network information is required to be included in the report. It is noted that the monitoring network wells are not clearly identified in the report. While Figure 1.2 is referenced, the figure appears to indicate nine RCRA monitoring wells. Upon reviewing the figure, it is assumed that wells 299-E33-33, 299-E33-36, 299-E33-41, 299-E33-43, 299-E33-32, 299-E33-42, and 299-E33-31 represent the seven B-BX-BY WMA assessment monitoring network wells. If this assumption is correct, it is noted the assessment report does not include discussions of wells 299-E33-43 and 299-E33-36. The assessment report must clearly identify the network and include discussion of all network wells.
80. Page 3.8, Section 3.4, 2nd paragraph. Re-write the last sentence in past tense. Recommended wording is: "Both were sampled for the first determination investigation."
81. Page 3.8, Section 3.4, 3rd paragraph. As indicated in a previous comment, Figure 1.2 identifies dozens of wells. It is not apparent which wells will be sampled for further determinations. Either identify the eight wells to be sampled in this section or in Chapter 6.0. It is recommended that this information be placed in Chapter 6.0.
82. Page 3.8, Section 3.4, 3rd paragraph. Insert the applicable regulatory citation in the sentence. Recommended wording is: "....eight others will be sampled for further determinations required by 40 CFR 265.93(d)(7)(i). These wells and their sampling frequency are identified in Chapter 6.0."
83. Page 3.8, Section 3.4.1. The sub-section does not appear to discuss or even reference the voluminous data and information contained in the "Hanford Tank Farms Vadose Zone Tank Summary Data Report for Tank BX-102" (September 1997, GJ-HAN-89). As such, the sub-section is both grossly deficient and misleading. Similarly, the sub-section does not appear to discuss or even reference the voluminous data and information contained in the "Hanford Tank Farms Vadose Zone Draft for External Technical Review Only BX Tank Farm Report" (June 1998, GJO-98-40-TAR, GJO-HAN-19). At the very minimum, the data and information contained in the "Hanford Tank Farms Vadose Zone Tank Summary Data Report for Tank BX-102" must be referenced and summarized in this sub-section. In other words, Ecology requires an integration of the information. It is Ecology's conclusion that the information and data contained in the BX-102 tank summary data report irrefutably indicates a release(s) to the vadose zone near and/or from the BX-102 tank has(have) occurred in relation to

the management of the RCRA TSD B-BX-BY WMA and that the released waste and/or waste constituents have migrated.

84. Page 3.8, Section 3.4.1, 2nd paragraph. Identify if non-radioactive tank waste constituents were "looked for" or monitored during the drilling of well 299-E33-41.
85. Page 3.8, Section 3.4.1, 2nd and 3rd paragraphs. Identify which constituents are beta, alpha, or gamma emitters.
86. Page 3.8, Section 3.4.1, 4th paragraph. In an appendix to this assessment, include the log data and information about the discrepancy noted in the borehole package.
87. Page 3.9, Section 3.4.1, 5th paragraph. Figure 1.2 indicates crib 216 B-7b operated from 1946 to 1967. Include this information in the text. Recommended wording is: "The crib nearest to well 299-E33-41 is 216 B-7b that operated from 1946 to 1967."
88. Page 3.9, Section 3.4.1, 5th paragraph. The word "remobilized" implies a stoppage of tank waste constituents. As the vadose zone contaminant transport mechanics are not yet completely understood, use of the word "migrating" would better describe the 241-BX-102 tank leak contamination. Replace "remobilized" with "migrating".
89. Page 3.9, Section 3.4.1, 4th paragraph. Include a description of the "design" of drywell 299-E33-141 (in particular, identify if the well was installed in tank fill material).
90. Page 3.9, Section 3.4.1, 5th paragraph. Re-write the last sentence of the paragraph to remove reference to "Phase II" assessment. In addition, the sentence must reflect the completion of the first determination. Recommended wording is: "Further mapping of the vadose zone contamination in this area may help delineate the BX-102 tank leak from other B-BX-BY WMA tank leaks and/or spills."
91. Page 3.10, Section 3.4.2, 1st paragraph. Change the first sentence to reflect the first determination of 40 CFR 265.93(d)(4) is complete. Recommended wording is: "With exception of cyanide data, any data received after February 1998 will be evaluated in further determinations required by 40 CFR 265.93(d)(7)(i)."
92. Page 3.10, Section 3.4.2, 1st bullet. Re-write the bullet to identify that the well 299-E33-32 conductivity values exceeded the critical mean (of 365.7 $\mu\text{mhos/cm}$) during the September 14, 1993, February 7, 1995, and February 6, 1996 sampling events. Also indicate that the statistical critical mean value was almost exceeded

during the August '95 sampling event. Recommended re-wording: "Conductivity values exceeded the critical mean in February 1993 and elevated B-BX-BY WMA waste constituent concentration trends were observed as early as February 1993. Given the elevated specific conductivity and waste constituent observations, the confirmation of releases from the unit to groundwater could have begun as early as 1993.

93. Page 3.10, Section 3.4.2, 2nd Bullet. Re-write the bullet analyzing all of the HEIS specific conductivity data to describe conductivity trends in relation to well 299-E33-41 rather than statistical critical means of an entire network or area. It is noted that many of the specific conductivity measurements at well 299-E33-41 were well below the 200 Area plateau background value of 344 $\mu\text{mhos/cm}$ until February 13, 1995.
94. Page 3.10, Section 3.4.2, 2nd Bullet. Delete the statement that "These changes were so transient that if the WMA had been monitored semiannually, neither of these high conductivity values would have been observed." Considering the HEIS data, it may be concluded that quarterly monitoring occurred due to the observation of contamination beginning in 1991. Due to the vadose zone information and the other groundwater information, the statement appears to take the observation out of context.
95. Page 3.10, Section 3.4.2, last paragraph. Change the wording in the second sentence to remove "remobilizing". Recommended wording is: "...possible consequences of further transporting of waste and/or waste constituents in the vadose zone."
96. Page 3.10, Section 3.4.2, last paragraph. The last sentence does not identify the occurrence and/or trends associated with waste constituents. While it is recognized that this section is only discussing conductivity trends, the wording of the statement is misleading. Change the last sentence to put the likelihood of the observation into perspective. Recommended wording is: "Alternatively, and without consideration of waste constituent trends, the gradual increase of specific conductivity could be caused by a return to ambient background conductivity. Due to the waste constituent observations, the likelihood of the trend being solely due to a return to ambient background conductivity is low."
97. Page 3.11, Section 3.4.2, 1st paragraph. Identify the highest measurement of technetium-99. Insert this identification between the fifth and sixth sentences.
98. Page 3.11, Section 3.4.2, 1st paragraph. Move the last sentence of the paragraph (regarding the drinking water standard) up and place it after the fourth sentence (which ends with "March 1991").

99. Page 3.11, Section 3.4.2, 1st paragraph. Include the observation that the highest technetium-99 measurement at well 299-E33-41 (12,000 pCi/L) represents an order of magnitude greater than the regional technetium-99 plume. Clearly identify that this observations can be attributed to neither the regional plume nor the nearby cribs.
100. Page 3.11, Section 3.4.2, 1st paragraph. Re-write the next to last sentence and identify the B-BX-BY WMA as the source of contamination observed at well 299-E33-41. Recommended wording is: "Clearly, the signature is distinct for well 299-E33-41, indicating a B-BX-BY WMA source."
101. Page 3.11, Section 3.4.2, 1st bullet. Change the word "strong" to "direct".
102. Page 3.12, Section 3.4.2, last paragraph. Insert "B-BX-BY WMA" between "indicating a" and "tank waste" in the last sentence.
103. Page 3.15, Section 3.4.2, 2nd paragraph. In the next to last sentence, replace "expanded assessment network" with "further determinations to be made pursuant to 40 CFR 265.93(d)(7)(i)."
104. Section 3.4.2. The section does not include a discussion of other indicator parameters (pH, TOX, and TOC) that are required to be monitored. Include a discussion(s) of these parameters in this section.
105. Page 3.16, Section 3.4.2, paragraph from preceding page. As Ecology considers this first determination assessment to have occurred from early '95 through February '98, include the uranium data collected since August '97. In particular, identify that uranium measurements in well 299-E33-41 are currently rising. For example, prior to the November 20, 1997 sampling event, uranium groundwater concentrations in this well had not been observed above the DWS of 20 pCi/L. From November 20, 1997 to May 4, 1998, uranium concentrations have been observed to occur above the DWS on every occasion (12 times).
106. Page 3.16, Section 3.4.2, paragraph from preceding page. The assessment report states that "...the occurrence of uranium (12 g/L) in well 299-E33-41 is not completely understood...". Delete the sentence and include a discussion of the uranium contamination occurring in the vadose zone as described in "Hanford Tank Farms Vadose Zone Tank Summary Data Report for Tank BX-102" (September 1997, GJ-HAN-89). Clearly, the uranium observations in well 299-E33-41 are more than understandable, they may be expected to remain elevated until the plume (see Figure 7 of "Hanford Tank Farms Vadose Zone Tank Summary Data Report for Tank BX-102" (September 1997, GJ-HAN-89)) has migrated beyond the well 299-E33-41 observation point.

107. Page 3.16, Section 3.4.2, paragraph from preceding page. The last sentence implies the future sampling will be done due to the increases observed in crib monitoring wells 299-E33-13, 299-E33-18, and 299-E33-38. Delete the sentence and identify in Chapter 6.0 that sampling of the B-BX-BY WMA RCRA TSD groundwater monitoring network for uranium will continue due to both the observations and the vadose zone contamination information.
108. Page 3.16, Section 3.4.2, 2nd paragraph. Cobalt-60 is discussed in relation to wells 299-E33-5 and 299-E33-13. Reference the applicable data and/or Figure 8 of "Hanford Tank Farms Vadose Zone Tank Summary Data Report for Tank BX-102" (September 1997, GJ-HAN-89) and discuss the cobalt-60 and europium-154 vadose zone information. Again, by the exclusion of vadose zone contamination information, the text of the groundwater assessment report is at best incomplete.
109. Page 3.16, Section 3.4.2, 2nd paragraph. Cesium-137 is discussed in relation to observed contamination, but does not include or reference the information of in "Hanford Tank Farms Vadose Zone Tank Summary Data Report for Tank BX-102" (September 1997, GJ-HAN-89). Reference the applicable data and/or Figure 6 of in "Hanford Tank Farms Vadose Zone Tank Summary Data Report for Tank BX-102" (September 1997, GJ-HAN-89) and discuss the cesium-137 vadose zone information.
110. Page 3.16, Section 3.4.2. It is noted that Section 3.4.2 does not discuss additional sampling results. What appears to be 40 CFR 265 Appendix IX-like sampling has been noted in the HEIS data. Include a thorough discussion of the additional data. Lastly, include an explanation of why this sampling was performed. This discussion should include observations about arsenic, chromium, and gross beta concentrations. Also, specify drinking water standard exceedence observations in the RCRA well network.
111. Page 3.17, Section 3.5, 1st paragraph. Replace "remobilized waste" in the second sentence with "contributed to migration of the waste and/or waste constituents."
112. Page 3.17, Section 3.5, 1st paragraph. Replace "was remobilizing tank waste" in the last sentence with "contributed to contaminant transport of B-BX-BY WMA waste and/or waste constituents."
113. Page 3.17, Section 3.5. Include an identification of the non-tank leaks described in Section 2.1.1 as tank farm occurrences. Although it is not necessary to repeat all of the information from Section 2.1.1 (page 2.4), it is appropriate to add the 1951 waste spill between tanks 241-BX-102 and 241-BX-103 as a bullet in Section 3.5.
114. Page 3.17, Section 3.5. Hanlon's 1997 reports appear to use terminology of "leakers" and "re-leakers". Identify in this assessment report that B-BX-BY

WMA tanks are considered to be "leakers" and which ones are considered to be "re-leakers".

115. Page 4.1, Section 4.0. A general comment about the entire chapter is that it must be re-written to include the voluminous vadose zone information available. In addition, the modeling should be re-evaluated to incorporate/integrate the vadose zone information. Upon re-modeling, the current scenarios with the extensive crib vadose zone contamination should be clearly described as not being the likely cause of contamination and/or not a good fit for the data/information.
116. Page 4.1, Section 4.0, 1st sentence. Delete the word "recently" as technetium-99 was observed to be gradually rising beginning in November 1992.
117. Page 4.1, Section 4.0, 1st paragraph. "Phase II" in the third sentence has no regulatory meaning. Delete the phrase "Phase II of the assessment" and replace it with "further determinations required by 40CFR 265.93(d)(7)(i)".
118. Page 4.1, Section 4.0, 1st paragraph. It is stated that the upward trending contamination observations in wells along the west side of BX and BY Tank Farms are "not developed sufficiently to determine sources." It is Ecology's conclusion that the first determination of 40 CFR 265.93(d)(4) has occurred from early 1995 to February 1998. It is also Ecology's conclusion that the first determination period has been sufficient to conclusively determine that the contamination observed in downgradient monitoring wells is from the B-BX-BY WMA. Therefore, delete the words "sources and" in the 2nd sentence.
119. Page 4.1, Section 4.0, 2nd paragraph. Change the wording "initial assessment" to "first determination assessment".
120. Page 4.1, Section 4.0, 2nd paragraph. Insert the words "tank waste chemistry" between "observations of" and "vadose zone contamination" in the fourth sentence.
121. Page 4.1, Section 4.1, 2nd paragraph. The modeling described does not include the information available from the other RCRA network wells or from the vadose zone work performed in the tank farm and in particular from the vadose zone work performed for tank BX-102. Section 4.1 must be re-written to consider the information available through February 1998. Recommended wording for the second sentence is: "These specific scenarios are focused on information and assumptions related to the contamination and trends observed at wells 299-E33-31, 299-E33-32, 299-E33-41, and 299-E33-42 as well as vadose zone investigation information contained in "Hanford Tank Farms Vadose Zone Tank Summary Data Report for Tank BX-102" (September 1997, GJ-HAN-89).

122. Page 4.1, Section 4.1, 2nd paragraph. Delete the word "unbiased" in the last sentence of the paragraph. As there is ample information indicating that the B-BX-BY WMA is the source of the vadose zone and groundwater contamination, it is inappropriate to consider the process unbiased. To the contrary, by not considering appropriate (and available) vadose zone and groundwater information, bias is an inherent attribute of the process. The process bias may be an issue in determining which B-BX-BY WMA tank and/or spill is the particular source. An unbiased process may be particularly important if the vadose and/or groundwater information indicated a "non-leaker" tank is currently leaking.
123. Page 4.1, Section 4.1, 3rd paragraph. As the modeling approach will be changed by the use of different assumptions, change the sentence to reflect which assumptions (without limitations) are being applied to the consideration. Recommended re-wording is: "The following appropriate assumptions are placed on the conceptualized pictures for the B-BX-BY WMA releases:"
124. Page 4.1, Section 4.1, 1st bullet. As shown in the previous section, the groundwater chemistry, contamination and/or indications at wells 299-E33-31, 299-E33-32, 299-E33-41, and 299-E33-42 clearly indicate contamination and/or vadose/groundwater impact from the B-BX-BY WMA. Recommended re-wording is: "Models are for multiple-well occurrences and trends. As shown in the previous section, the groundwater and vadose zone signatures at groundwater wells 299-E33-31, 299-E33-32, 299-E33-41, and 299-E33-42 and at numerous BX tank farm boreholes appear to be uniquely similar."
125. Page 4.1, Section 4.1, 2nd bullet. According to Hanlon's February waste tank summary report, the B-BX-BY tanks contain 896,000 gallons of drainable liquid. In addition, tank farm occurrences have been documented. Recommended re-wording of the second bullet is: "Sources are B-BX-BY WMA waste, spills and/or leaks, and migrating vadose zone plumes. Because there is a total of approximately 900,000 gallons of drainable liquid waste left in certain tanks, there are at least 18 designated "leakers", and there are documented tank farm occurrences, migrating vadose zone plumes and the B-BX-BY WMA waste spills and/or leaks are identified as sources."
126. Page 4.1, Section 4.1, 3rd bullet. The chemistry and trend plots of wells 299-E33-31, 299-E33-32, 299-E33-41, and 299-E33-42 give a unique signature not observed in crib or upgradient wells. Therefore, the recommended re-wording of the third bullet is: "The driving force for contaminant transport to groundwater is surface or near surface water and/or B-BX-BY WMA tank wastes. A water source may be natural precipitation as is supported by the observance of similar chemistry and trends in wells 299-E33-31, 299-E33-32, 299-E33-41, and 299-E33-42."

127. Page 4.2, Section 4.1, 1st bullet. Identify that infiltration studies for non-saturated gravity flow have not been performed for the upper section of the sediment package.
128. Page 4.2, Section 4.1, 2nd bullet. For purposes of this level of modeling, groundwater flow direction is sufficiently understood. In addition, there is a great deal of B-BX-BY WMA vadose zone monitoring data points available to use in relation to this model assumption. It should be noted that if vadose zone monitoring data points are available for the surrounding waste management units, the data may also be used in the model. Recommended re-wording is:
"Contaminants migrate through the vadose zone and intersect monitoring wells. Although groundwater flow direction has recently been observed to be changing, the local groundwater flow direction in the vicinity of the downgradient monitoring wells combined with the vadose zone monitoring information are considered for the various scenarios."
129. Page 4.2, Section 4.1, 4th complete paragraph. Insert the following sentence between the last and next to last sentences: "Inclusion of the numerous vadose zone data qualitatively reduces the sudden, sharp increases seen in groundwater data by also considering a breakthrough curve for the vadose zone."
130. Page 4.2, Section 4.1, item number 1. Change the first bullet to identify "past and/or present tank leaks" rather than "tanks".
131. Page 4.2, Section 4.1, item number 1. Insert an additional bullet: "Vadose zone contamination from tank spills and/or releases".
132. Page 4.2, Section 4.1, new item (2A). Insert an additional item: "Distance from the borehole to the water source".
133. Page 4.3, Section 4.1, item number 7. Insert "and/or indicator parameter" between the words "chemical" and "trend".
134. Page 4.3, Section 4.1, item number 8. Insert "and/or indicator parameter" between the words "chemical" and "correlations".
135. Page 5.1, Section 5.0, 1st paragraph. Delete the term "Phase I" in the first sentence.
136. Page 5.1, Section 5.0, 1st paragraph. Change the word "decisions" to "determinations" in the first sentence.
137. Page 5.1, Section 5.0, 1st paragraph. Insert the following sentence between the first and second sentences: "The determination must be based upon the collection of additional samples and analysis/evaluation of the data."

138. Page 5.1, Section 5.0, 1st paragraph. Delete the phrase "and the results support this conclusion" in the second sentence.
139. Page 5.1, Section 5.0, 1st paragraph. Change the word "decision" to determination in the third sentence.
140. Page 5.1, Section 5.0, 1st paragraph. Re-write the last sentence of the paragraph and identify that it was concluded from the first determination, that the B-BX-BY WMA has negatively impacted groundwater. Recommended wording is: "It is concluded that spills and/or leaks from the current/past operation of the B-BX-BY WMA have resulted in groundwater contamination."
141. Page 5.1, Section 5.0, 1st bullet. Delete the word "recent" in the first sentence.
142. Page 5.1, Section 5.0, 1st bullet. Delete the word "remobilized" and insert the word "releases" between the words "waste" and "from" in the first sentence. Also, insert the identifier "B-BX-BY" in front of "WMA".
143. Page 5.1, Section 5.0, 1st bullet. Re-write the second sentence as: "The trend plot characteristics combined with the well's proximity to known tank farm occurrence locations and with documentation of local water driving forces indicate that the observed groundwater contamination may be attributed solely to tank waste releases from the B-BX-BY WMA."
144. Page 5.1, Section 5.0, 1st bullet. Insert the following sentence between the second and third sentences: "Data reported in February and August 1995 showed that the DWS of technetium-99 (900 pCi/L) was exceeded."
145. Page 5.1, Section 5.0, 1st bullet. Insert an identification/description of technetium-99 occurrences from August 1997 to February 1998.
146. Page 5.1, Section 5.0, 2nd bullet. Include an identification of the vadose zone information contained in "Hanford Tank Farms Vadose Zone Tank Summary Data Report for Tank BX-102" (September 1997, GJ-HAN-89).
147. Page 5.1, Section 5.0, 2nd bullet. Change the last sentence of the bullet to item number 6. Recommended wording is: "... (70,000 gallons), the overflow/spill that occurred in 1951 of 30,000 to 90,000 gallons between tanks 241-BX-102 and 241-BX-103."
148. Page 5.1, Section 5.0, 2nd bullet. Include an identification of infiltration studies/experiments performed near the B-BX-BY WMA. Recommended wording is: "...BX-103, and infiltration studies conducted at the 200 East Area/105 A Mock Tank Site".

149. Page 5.1, Section 5.0, 2nd bullet. Change “this contamination is remobilized vadose waste” to “vadose zone contamination and/or waste constituents are migrating”.
150. Page 5.1, Section 5.0, 2nd bullet. Change “may have” in the last sentence to “has very likely contributed and/or is contributing”.
151. Page 5.1, Section 5.0, 3rd bullet. Change “may” in the first sentence to “are concluded to” and insert “B-BX-BY” between “the” and “WMA”.
152. Page 5.1, Section 5.0, 3rd bullet. Insert the following sentence between the first and second sentences: “As evidenced by the trend analyses discussed in this report, the first determination conclusion is that the B-BX-BY WMA is the source of contamination.
153. Page 5.1, Section 5.0, 3rd bullet. While the situation may be dynamic, the data and data trend analyses leave no question as to the source of the contamination. Delete the third sentence.
154. Page 5.1, Section 5.0, 3rd bullet. Delete the last sentence of the bullet and replace it with the following sentence: “Further determinations of contaminant migration extent, transport rates and concentrations will continue to be made.”
155. Page 5.1, Section 5.0, 3rd paragraph. Change the first sentence to read: “The contamination observed at well 299-E33-41 has entered the groundwater as evidenced by the gradual and/or sharp elevations of nitrate, chloride, sulfate, sodium, technetium-99, and uranium.”
156. Page 5.1, Section 5.0, 3rd paragraph. As the extent of contamination is not yet determined and as the comparison between concentrations of waste constituents occurring in groundwater versus concentrations of waste constituents occurring in the B-BX-BY tanks is inappropriate, delete the second sentence of the paragraph.
157. Page 5.1, Section 5.0, 3rd paragraph. As the overall impact of the releases from the B-BX-BY WMA has not yet been determined and as the qualitative and the comparison to other contamination plumes is both pre-mature and inappropriate without this information, delete the third sentence of the paragraph.
158. Page 5.1, Section 5.0, 4th paragraph. Re-write the sentence to state: “The open issues noted above, and further assessment of the groundwater contamination attributable to B-BX-BY WMA will be addressed in the further determinations to be made as described in Chapter 6 of this document.

159. Page 6.1, Section 6.0, title. Change the title to: "Proposed Further Determination Actions".
160. Page 6.1, Section 6.0. Re-write the first and second sentences as: "The first determination of 40 CFR 265.93(d)(4-6) of the B-BX-BY WMA concluded that the WMA has negatively impacted groundwater quality and further determinations of the B-BX-BY WMA as required by 40 CFR 265.93(d)(7)(I) will be performed. The following actions will be performed".
161. Page 6.1, Section 6.0, item number 1. Re-write the item to identify the following: "Quarterly monitoring will continue for the following RCRA wells: 299-E33-31, 299-E33-32, 299-E33-33, 299-E33-41, and 299-E33-42. The monitoring will occur to a) measure contaminant concentrations, b) measure rate of contaminant transport, c) monitor the changing groundwater flow and, d) monitor the decreasing water table. The RCRA groundwater monitoring network will, at a minimum, monitor the following constituents and parameters: arsenic, calcium, cadmium, chloride, chromium, fluoride, iron, lead, nickel, nitrate, phosphate, phosphorous, potassium, silver, sodium, sulfate, sulfur, zinc, technetium-99, uranium, and gross beta."
162. Page 6.1, Section 6.0, item number 2. Re-write this item to identify and propose actions to evaluate the following contaminated vadose zone issues: 1) depth, concentration, and distribution measurements of the cesium-137 and the effect, if any, of borehole contamination around borehole 21-02-04, 2) determination of the depth extent of the uranium and whether the uranium identified just above the groundwater in borehole 299-E33-41 originated from the BX-102 tank leak, 3) seal borehole 21-27-11 to prevent future spread of contaminants, 4) non-gamma-emitting plume characterization, and 5) periodic borehole monitoring to identify short-term changes caused by a possible large moisture flux or a new tank leak and to identify the long-term changes resulting from steady-state migration of the radionuclides.
163. Page 6.1, Section 6.0, item number 3. Add the following to the third item: "This will be performed by collecting same-day water table elevations from the following wells: 299-E33-31, 299-E33-32, 299-E33-33, 299-E33-36, 299-E33-38, 299-E33-39, 299-E33-41, 299-E33-42, and 299-E33-43."
164. Page 6.1, Section 6.0. Include an indication that due to the recently changing groundwater flow direction, estimates of groundwater sampling capabilities associated with this network will be provided in each B-BX-BY WMA assessment report. This indication should be similar to the third sentence of the fifth paragraph in Section 3.2 (page 3.4) of this report.
165. Page 6.1, Section 6.0, item number 4. As the specific conductance will be measured as well as water table elevations, the information of item 4 is not

necessary in relation to the B-BX-BY WMA contamination further determinations. Delete the item.

166. Page 6.1, Section 6.0, last paragraph. Insert an identification that an annual report will be generated. Indicate that the annual report will describe the observations made during the previous year. Also, delete the first sentence of the last paragraph. This section should clearly identify the path forward.
167. Page 6.1, Section 6.0, last paragraph. Re-write the last sentence of the last paragraph to state the following: "Until this report and plan, which includes proposed actions for further determinations, is approved by the regulator, sampling will continue quarterly with monthly sampling as necessary."

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ATTACHMENT E - INTERIM MEASURES REQUIREMENTS

The following conditions shall apply to the performance of interim measures at the Facility:

1. The Permittee shall continuously consider and evaluate information regarding releases at the Facility, and the nature and extent of contamination from hazardous wastes and/or hazardous constituents at or from the Facility, as learned in connection with performance of the RFI or other investigations. In the event the Permittee identifies an imminent and substantial endangerment to human health or the environment based on such information, the Permittee shall immediately notify EPA and Ecology orally, and shall notify EPA and Ecology in writing within seven (7) days, summarizing the immediacy and magnitude of such identified threats.
2. If the Agency determines that any release or threat of release of hazardous wastes, hazardous constituents, or hazardous substance(s) at or from the Facility presents an imminent and substantial endangerment to human health or the environment, then the Permittee shall formulate a set of interim or stabilization measures. This determination will be based on the Permittee's evaluation, and/or an independent evaluation by the Agency, of information indicating an imminent and substantial endangerment to human health or to the environment. Interim or stabilization measures shall be those which, when implemented, will mitigate the release or threat of release, or which can effectively mitigate the impact on receptors affected by such releases. To the maximum extent practicable, interim and stabilization measures should be consistent with and capable of being integrated into long term corrective measures at the Facility. The Permittee shall prepare and submit within twenty-one (21) days, or by such earlier or later date as may be required by the Agency, an interim measures ("IM") workplan to address the release or threat of release that presents an imminent and substantial endangerment to human health or the environment. This workplan shall include:
 - (a) Interim Measure Objectives;
 - (b) A Health and Safety Plan;
 - (c) A Public Involvement (or Community Relations) Plan;
 - (d) A Data Collection Quality Assurance Plan;
 - (e) A Data Management Plan;
 - (f) Design and Specifications;
 - (g) An Operation and Maintenance Plan;

- d. Results of Facility monitoring, indicating that the corrective measure will meet or exceed the performance criteria; and
- e. Explanation of the operation and maintenance (including monitoring) to be undertaken at the facility.

This report should include all of the inspection summary reports, inspection data sheets, problem identification and corrective measure reports, photographic reporting data sheets, design engineers' acceptance reports, deviations from design and material specification (with justifying documentation), and as-built drawings.

PART II - CORRECTIVE ACTION

II.A. APPLICABILITY

The Conditions of this Part apply to:

- II.A.1. The solid waste management units (SWMUs) [and areas of concern (AOCs)] identified in Appendix A-1, which require further investigation.
- II.A.2. The SWMUs [and AOCs] identified in Appendix A-2, which require no further investigation at this time.
- II.A.3. The SWMUs [and AOCs] identified in Appendix A-3, which require confirmatory sampling.
- II.A.4. Any additional SWMUs or AOCs discovered during the course of groundwater monitoring, field investigations, environmental audits, or other means.

II.B. NOTIFICATION AND ASSESSMENT REQUIREMENTS FOR NEWLY IDENTIFIED SWMUs AND AOCs

- II.B.1. The Permittee shall notify the Regional Administrator in writing, within [fifteen (15)] calendar days of discovery, of any additional SWMUs as discovered under Condition [II.A.4].
- II.B.2. The Permittee shall notify the Regional Administrator in writing, within [fifteen (15)] calendar days of discovery, of any additional AOCs as discovered under Condition [II.A.4]. The notification shall include, at a minimum, the location of the AOC and all available information pertaining to the nature of the release (e.g., media affected, hazardous constituents released, magnitude of release, etc.). If the Regional Administrator determines that further investigation of an AOC is required, the permit will be modified in accordance with 40 CFR §270.41.
- II.B.3. The Permittee shall prepare and submit to the Regional Administrator, within [ninety (90)] calendar days of notification, a SWMU Assessment Report (SAR) for each SWMU identified under Condition [II.B.1]. At a minimum, the SAR shall provide the following information:
 - a. Location of unit(s) on a topographic map of appropriate scale such as required under 40 CFR §270.14(b)(19).
 - b. Designation of type and function of unit(s).
 - c. General dimensions, capacities and structural description of unit(s) (supply any available plans/drawings).

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- d. Dates that the unit(s) was operated.
- e. Specification of all wastes that have been managed at/in the unit(s) to the extent available. Include any available data on 40 CFR Part 261, Appendix VIII, constituents in the wastes.
- f. All available information pertaining to any release of hazardous waste or hazardous constituents from such unit(s) (to include groundwater data, soil analyses, air, and/or surface water data).

II.B.4. Based on the results of the SAR, the Regional Administrator shall determine the need for further investigations at the SWMUs covered in the SAR. If the Regional Administrator determines that such investigations are needed, the Permittee shall be required to prepare a plan for such investigations as outlined in Condition [II.B.1.b].

II.C. NOTIFICATION REQUIREMENTS FOR NEWLY DISCOVERED RELEASES AT PREVIOUSLY IDENTIFIED SWMUs [or AOCs]

II.C.1. The Permittee shall notify the Regional Administrator in writing of any newly discovered release(s) of hazardous waste or hazardous constituents discovered during the course of groundwater monitoring, field investigations, environmental audits, or other means, within [fifteen (15)] calendar days of discovery. Such newly discovered releases may be from SWMUs [or AOCs] identified in Condition [II.A.2] or SWMUs identified in Condition [II.A.4] for which further investigation under Condition [II.B.4] was not required.

II.C.2. If the Regional Administrator determines that further investigation of the SWMUs [or AOCs] is needed, the Permittee shall be required to prepare a plan for such investigations as outlined in Condition [II.B.1.b].

II.D. Confirmatory Sampling (CS)

II.D.1. The Permittee shall prepare and submit to the Regional Administrator, within [ten (10)] calendar days of the effective date of this permit, a Confirmatory Sampling (CS) Workplan to determine any release from SWMUs [and AOCs] identified in Condition [II.A.3] and [Appendix A-4]. The CS Workplan shall include schedules of implementation and completion of specific actions necessary to determine a release. It should also address applicable requirements and affected media. Completion of all Confirmatory Sampling shall not exceed [forty-five (45)] days.

- II.D.2. The CS Workplan must be approved by the Regional Administrator, in writing, prior to implementation. The Regional Administrator shall specify the start date of the CS Workplan schedule in the letter approving the CS Workplan. If the Regional Administrator disapproves the CS Workplan, the Regional Administrator shall either (1) notify the Permittee in writing of the CS Workplan's deficiencies and specify a due date for submission of a revised CS Workplan, or (2) revise the CS Workplan and notify the Permittee of the revisions.
- II.D.3. The Permittee shall implement the confirmatory sampling in accordance with the approved CS Workplan.
- II.D.4. The Permittee shall prepare and submit to the Regional Administrator in accordance with the approved schedule, a Confirmatory Sampling (CS) Report identifying those SWMUs [and AOCs] listed in Condition [II.A.3] that have released hazardous waste or hazardous constituents into the environment. The CS Report shall include all data, including raw data, and a summary and analysis of the data, that supports the above determination.
- II.D.5. Based on the results of the CS Report, the Regional Administrator shall determine the need for further investigations at the SWMUs [and AOCs] covered in the CS Report. If the Regional Administrator determines that such investigations are needed, the Permittee shall be required to prepare a plan for such investigations as outlined in Condition [II.E.1.b]. The RA will notify the permittee of any no further action decision.

II.E. RCRA FACILITY INVESTIGATION (RFI)

II.E.1. RFI Workplan(s)

- II.E.1.a. The Permittee shall prepare and submit to the Regional Administrator, within [one hundred twenty (120)] calendar days of the effective date of this permit, a RCRA Facility Investigation (RFI) Workplan(s) for those units identified in Condition [II.A.1]. This Workplan shall be developed to meet the requirements of Condition [II.E.1.c].
- II.E.1.b. The Permittee shall prepare and submit to the Regional Administrator, within [ninety (90)] calendar days of notification by the Regional Administrator, an RFI Workplan for those units identified under Condition [II.B.4], Condition [II.C.2], or Condition [II.D.5]. The RFI Workplan(s) shall be developed to meet the requirements of Condition [II.E.1.c].

DEPARTMENT OF ECOLOGY

September 22, 1998

TO: Jay Manning, Deputy Assistant Attorney General
Attorney Generals Office

THRU: Alex Stone, Acting TWRS Storage Project Manager
Nuclear Waste Program *AS*

FROM: Stan Leja, Hydrogeologist
Nuclear Waste Program *SL*

Alisa Huckaby, Environmental Specialist
Nuclear Waste Program *AH*

SUBJECT: Impact to Groundwater From Single-Shell Tank Farms

Summary of Meeting Statements Themes and Concerns:

A meeting on implementing corrective action at the single-shell tank farms resulted in a number of statements and themes that resulted from these statements which were inaccurate or misleading. The statements, their implied meanings, and our concerns are as follows:

- **The magnitude of groundwater contamination from liquid disposal facilities is orders of magnitude greater than groundwater contamination from tank farms.** This is incorrect and creates a false impression of the significance of the issue.
- **Sitewide vadose zone contamination is delineated.** This statement is inaccurate and not supported by subsurface data.
- **The volume of tank leaks is known.** Tank leak volumes are not known. USDOE has officially recognized that approximately one million gallons has leaked from the tanks. This approximation is refuted by recent USDOE calculations.
- **Tank waste constituents will not migrate significant distances below the tank bottoms.** This assumption has been refuted by data collected at S/SX, B/BX/BY and T/TX/TY tank farms. Tank waste constituents have impacted groundwater at these facilities.

- **Aquifer properties are understood and the hydraulic flow regime can be controlled.** This statement is false. We have only a very general understanding of aquifer properties. We have no proof that we can control groundwater flow.

During the September 3, 1998, meeting between the Environmental Protection Agency (EPA), and Ecology on implementing vadose zone corrective action, an issue was raised concerning the magnitude of groundwater contamination from leaking single-shell tanks (SSTs). This memo has been prepared to clarify statements made regarding this issue. We are concerned that inaccurate statements regarding the potential of vadose zone contamination beneath the tank farms to impact groundwater created an impression at the meeting that future groundwater contamination from leaking tanks was not a high priority issue and that any serious threats to the groundwater were already being or could be adequately addressed through existing groundwater remedial actions.

"Concentrations of contaminants in the groundwater that resulted from the discharge of liquid waste to cribs, ponds, and ditches are many orders of magnitude greater than the concentrations of contaminants in the groundwater that stemmed from leaking tanks."

This assertion by Doug Sherwood, EPA, made during the meeting, is misleading for a number of contaminants. Review of Hanford Environmental Information System (HEIS) groundwater data shows that concentrations of many contaminants in the groundwater that are common to both sources, are of the same order of magnitude. For example, technetium 99 in the groundwater beneath the B/BX/BY and S/SX tank farms that is the result of leaking tanks has been detected at maximum concentrations of 12,000 pCi/L and 8,700 pCi/L, respectively. The maximum concentration of technetium 99 present in the UP-1 groundwater operable unit as a result of the discharge of liquid waste to the U-1 and U-2 cribs is 28,600 pCi/L. The UP-1 operable unit technetium 99 concentrations therefore, are 2.4 and 3.3 times the concentrations of the technetium 99 beneath the B/BX/BY and S/SX tank farms. The concentrations are not even one order of magnitude, much less "many orders of magnitude greater" as claimed. Downgradient of the T/TX/TY tank farm technetium 99 that has entered the groundwater from tank leaks and/or spills has recently been measured at a concentration of 17,900 pCi/L. This is 1.6 times less than the concentration of technetium 99 in the UP-1 groundwater operable unit.

Chromium detected in the groundwater in the vicinity of the TX/TY Tank Farm has been attributed to the discharge of liquid wastes to the 216-T-26 and 216-T-28 Cribs. Recent detection of chromium from groundwater samples at concentrations of 550 µg/L to 930 µg/L in wells upgradient and sidegradient to these cribs suggests the TX/TY tank farm as a source. In addition, chromium was detected at a concentration of 6100 µg/L in a groundwater sample from a well downgradient of the T tank farm. The concentration of chromium from this well is higher than any chromium concentration from groundwater collected from any well upgradient of the T tank farm. In general, groundwater chromium concentrations are greater in the downgradient vicinity of the T/TX/TY tank

farms than in the 100 Areas, where chromium is being remediated through groundwater pump-and-treat operations. Additional determinations of groundwater contamination for the groundwater assessment monitoring program at these tank farms are required by regulation and must provide more information on the extent of groundwater contamination.

Iodine 129 concentrations detected recently in groundwater monitoring wells downgradient of the TX/TY tank farms are higher than in wells upgradient of the TX/TY tank farms. They are also higher than iodine 129 groundwater concentrations in other areas of the site. Iodine 129 was detected in these wells at concentrations of over 80 pCi/L, much higher than peak Iodine 129 concentrations in the groundwater in the 200 East Area.

These examples clearly show that contaminant impact to the groundwater from leaking and/or spilled tank wastes is significant despite the smaller areal extent of these plumes compared to contaminant plumes originating from liquid disposal facilities. What is most important, however, is not brought out in groundwater contaminant concentration values. Most importantly is the potential for the vadose zone beneath the tank farms to be the source of increasing future groundwater impact. A number of tank waste constituents are found in the vadose zone surrounding the SSTs. Their mobility, half-life, and toxicity will pose a threat to the Columbia River for hundreds of years. To disregard this threat places the current cleanup approach, (existing TPA priorities) on a foundation of inaccurate assumptions and simplistic generalizations that gloss over large gaps in knowledge of the vadose zone and the hydrogeologic system. We are particularly concerned with statements or what is being implied by statements made during the discussion on the following issues:

- ***USDOE and the regulators have a thorough understanding of the nature and extent of vadose zone contamination throughout the site.*** Such a conclusion is inaccurate and rests on the assumption that inventory knowledge of wastes sent to liquid disposal facilities is valid. ***Neither USDOE nor the regulators have credible data on the amounts and concentrations of wastes or waste constituents that were sent to liquid disposal facilities.*** It was also implied during the meeting that the vadose zone beneath these disposal facilities would contain greater amounts of adsorbed contaminants than the vadose zone beneath the tank farms. We have no data to support such a conclusion. In fact, based on information obtained during the characterization of the 1301-N and 1325-N Liquid Disposal Facilities, much of the contamination assumed to be held in the vadose zone beneath disposal cribs, ponds and ditches has already been flushed to the groundwater as a result of the large volume of liquid discharge. Conversely, contamination in the vadose zone beneath the tank farms is not expected to have been flushed to the groundwater because of the smaller volumes of wastes leaked and the significantly higher concentrations of dangerous waste constituents in the wastes.

- ***The volume of tank leaks is known and supported by leak data.*** This again is not the case. There is a large discrepancy between the Hanlon and Agnew leak estimates. Agnew's estimate of the leak volumes at the SX tank farm is much higher than Hanlon's estimate. Presently Ecology believes that the Agnew Historical Leak Model is based on better methodology and provides a more accurate estimate of leak volumes. In addition to the leak volume, the total curie load that has escaped from the tanks and ancillary facilities is much larger in the Agnew estimate than the Hanlon estimate. It follows, that extrapolating the Agnew estimate to the other Tank Farms in the 200 West and the B/BX/BY tank farm in the 200 area would result in a much larger volume of tank leaks than the 1 million gallons officially recognized by USDOE and the regulators.
- ***The waste constituents that have leaked from the tank farms will not migrate very far below the bottom of the tanks.*** We know from the information compiled during the S/SX vadose zone characterization work that this assumption is not true. Mobile constituents such as technetium 99 have reached the groundwater in appreciable quantities. Other constituents such as chromium and iodine 129 have also reached the groundwater. What is most troubling about the data collected to date is that the characteristics of the tank wastes result in an environment where even high k_d constituents such as cesium 137 migrate much further than expected. Wastes that have high pH, high sodium content, contain organic complexants and ferrocyanide will migrate further and more rapidly than previous scientific knowledge indicated.
- ***We understand and can control hydraulic flow in the aquifers beneath the Hanford Site.*** This conclusion was implied during the meeting, and is a gross generalization. We lack any detailed knowledge of the aquifers at Hanford. We know the depths to the major geologic units that comprise the hydrogeologic system, and general properties of these units. We do not understand the detailed hydraulic flow beneath the site. We do not know the locations or distributions of preferential pathways, horizontal and vertical in the aquifers. We do not understand the changes to flowpaths as groundwater elevations decline, and we do not know the vertical distribution of contaminants in the major plumes across the site. Based on these large data gaps, we certainly cannot assume that we can control the flow of groundwater beneath the site, especially in perpetuity.

In summary the vadose zone beneath the tank farms is uncharted territory. We understand neither the mechanisms of contaminant transport in the vadose zone nor the nature and extent of contamination beneath the tank farms. We have based much of our decision-making in regards to cleanup strategies on inaccurate assumptions as to the amount of contamination that leaked from the single-shell tanks (SSTs), and on the mistaken belief by USDOE that contaminants that leaked from the tanks would be adsorbed by the soil column and would not migrate more than a few feet below the bottom of the tanks. We know from information collected at the S/SX tank farms that this is not true. Contamination from the tanks has impacted groundwater. It would be

inappropriate to assume or conclude that this groundwater contamination represents anything less than the bow wave of much greater contamination currently occurring in the vadose zone. The only valid and defensible approach that the regulators can take with this issue is to acknowledge our informed understanding related to this contamination. It's time that this issue is given the priority that it deserves.

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